CHILD SEXUAL OFFENDERS' RECOGNITION OF FACIAL AFFECT: ARE OFFENDERS LESS SENSITIVE TO EMOTIONS IN CHILDREN?

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Abstract

Understanding the risk factors that contribute to sexual offending against children is an important topic for research. The present study set out to examine whether deficits in emotion recognition might contribute to sexual offending, by testing if child sexual offenders were impaired in their recognition of facial expressions of emotion, particularly with children, relative to non-offender controls. To do this, we tested 49 child sexual offenders and 46 non-offender controls on their ability to recognise facial expressions of emotion using photographs of both adults and children posing emotions from the Radboud Faces Database (Langner et al., 2010). We created continua along six emotion pairs (e.g. happiness-sadness) in 10% increments, from the emotions of sadness, anger, happiness, and fear, with morphing software.

Using signal detection analyses, we found that across the emotion pairs, non-offenders were significantly better able to discriminate between emotions than offenders, although there were no significant differences within individual emotion pairs, and was not significant with either age or level of education as a covariate. When discriminating between fear and anger, non-offenders showed a significant bias towards labeling an emotion as fear when judging male faces, whereas offenders did not, and this difference remained significant with age, level of education and socioeconomic status as covariates. Additionally, both groups showed a strong bias towards labeling an emotion as anger when judging female faces. Thus sexual offenders were more likely to identify anger rather than fear with male faces, suggesting that sexual offenders lack an inhibition against recognising anger in males that non-offenders showed.

Overall, contrary to our predictions, we found no evidence to indicate that child sexual offenders showed a specific deficit in their recognition of emotions in children. However, future research should continue to examine this area and its potential link to recidivism.

Overview

Child sexual offenders are an important group to study due to the nature of their offending and the impact it has on their victims. This research helps to inform treatment programmes, which aim to reduce reoffending. Current research suggests that sexual offenders may have difficulty recognising emotions in others, and that emotion recognition is a crucial aspect of an empathic response (e.g. Barnett & Mann, 2013; Gery, Miljkovitch, Berthoz, & Soussignan, 2009; Hudson et al., 1993; Marsh & Blair, 2008; Ward, Keenan, & Hudson, 2000). Therefore, a deficit in empathy may reduce an offenders' ability to recognise distress in potential victims, helping to facilitate an offence. Unfortunately, this area of research has not received much attention, and studies involving the ability of child sexual offenders to recognise emotions in children are few in number. In addition, most of these studies suffer from low sample sizes, making generalisations difficult. Therefore, the present study aims to test the emotion recognition abilities of child sexual offenders, with both adult and child models while utilising a larger sample of offenders.

This thesis is organised as follows. First, a literature review is presented which provides the background for the empirical study. We begin by briefly reviewing the literature on the expression and recognition of facial expressions. We then examine the development of the ability to link facial expressions to distinct emotional states, and factors which can impair our ability to recognise facial expressions, such as brain damage and childhood trauma. Following this, we examine the existence of biases, which affect our emotion recognition abilities and we look into specific biases shown by child sexual offenders, as well as several factors which can affect the accuracy of their recognition. Finally, we examine the literature on the emotion recognition abilities of child sexual offenders before detailing our aims for the present study. Second, we describe the participants and our experimental method. Third, we present the results of our statistical analyses, and finally, we discuss the implications of these results on our understanding of the emotion recognition abilities of sexual offenders.

1. Introduction and General Theory

The experience of emotions is an important part of our lives. Our emotions influence us in a variety of ways, such as relationship building, decision making, and forming attitudes, and can help keep us safe from danger. Emotions have evolved through adaptation to our surroundings over many generations (phylogenetic contribution) and continue to develop through social learning over our own lifespan, especially during infancy and childhood (ontogenetic contribution) (Ekman & Cordaro, 2011). According to Ekman (1999, p.172) "Each of the basic emotions [fear, sadness, happiness, anger, contempt, disgust, and surprise] is not a single affective state but a *family* of related states." That is to say, there are multiple ways to experience each of these seven basic emotions (e.g. amusement, relief, excitement, wonder, and ecstasy all belong to the family of enjoyable emotions). There are also multiple muscular configurations for the accompanying facial expressions of each emotion, not just a single configuration (e.g. there are more than 60 different anger expressions; Ekman & Friesen, 1975). The facial expressions in a family share certain configurational features, which differentiate them from the families of other expressions. This diversity could potentially serve to distinguish between the different contexts of emotional arousal (e.g. simulated anger versus controlled anger), as well as intensities (e.g. annoyance versus rage) (Ekman, 1992). However, emotion can exist without expression and vice versa (Ekman, 1999). In certain contexts we may wish to inhibit the appearance of our emotions (emotion without expression) and in other contexts we may wish to suggest we are experiencing an emotion when in fact we are not (expression without emotion). It is more difficult to inhibit an emotion than to fabricate one, as emotions have a very fast onset, they can happen before the individual is aware that they have begun. This is an adaptive function that sometimes may work against us, yet it allows us to quickly mobilise when responding to important events (Ekman, 1999). Therefore, there must be a set of instructions that reflect our own personal history and evolutionary adaptations, which guides our actions (Ekman & Cordaro, 2011). Tomkins & McCarter (1964) proposed an inherited central mechanism they called an *affect program,* which

directs emotional behaviour. Affect programs are sub-cortical structures, which are able to control the rate and duration of a variety of muscles and glands in specific ways, which are characteristic of the emotion that is being experienced.

1.1. The development of interpreting and expressing emotion

Emotions are incredibly complex phenomena and thus it is important to understand when and how our ability to recognise and interpret emotional states in others develops, as well as our own ability to convey the emotions we feel (or wish others to think that we feel) via facial expressions.

1.1.1. Facial expressions of emotion

Our ability to develop and manage interpersonal relationships relies primarily on our ability to infer the emotional states of others through both verbal and non-verbal cues. Verbal cues can provide a simple and to the point description of how a person is feeling, often with little room for incorrect interpretation. On the other hand, non-verbal cues include body language and facial expressions such as 'macroexpressions', which are produced when emotions occur and typically last between 0.5 and 4 seconds (Ekman, 2003). Non-verbal cues can also be much more subtle than verbal cues. In fact, non-verbal cues can be so subtle that the person displaying them can be completely unaware that they are doing so. These subtle 'microexpressions' are "extremely quick facial expressions of emotion that appear on the face for less than ½ a second" (Matsumoto & Hwang, 2011, p.181). Unlike macroexpressions, microexpressions are likely signs of concealed or deceitful emotions, which occur when an individual is experiencing an intensely emotional situation but cannot afford to let others see how they are feeling. The ability to detect microexpressions in these situations will undoubtedly be beneficial in evaluating the truthfulness and intentions of the individual (Frank & Ekman, 1997).

Contrary to the findings of research before them, Paul Ekman and colleagues (e.g. Ekman & Friesen, 1971; Ekman, Sorenson, & Friesen, 1969;

Izard, 1971) found agreement across a dozen Western and non-Western cultures (and in a subsequent study, a visually isolated pre-literate culture in New Guinea) in correctly recognizing the emotions displayed in photographs of posed Caucasian facial expressions. These emotions were also recognizable to Westerners when displayed by the New Guineans (Ekman, Rolls, Perrett, & Ellis, 1992). These results strongly opposed previous research that facial expressions are socially learned and culturally variable (e.g. Hunt, 1941; Munn, 1940). Further studies supported the notion of universal facial expressions using Japanese and American participants videotaped watching emotion-inducing films. For example, a study by Ekman (1972) found no differences between these two cultures when the participants thought they were alone, yet when an authority figure was present, Japanese participants masked their negative expressions more than the Americans, through the use of positive expressions. This likely resulted in microexpressions of negative emotion being leaked by the Japanese participants, although this was not reported.

1.1.2. Theory of mind

Theory of mind (ToM) refers to the ability of a person to infer the emotional states of the self and others (Premack & Woodruff, 1978). That is, an awareness that "…different individuals can have different thoughts" (Frith & Frith, 2003, p.459). Evidence of ToM begins to emerge in stages from around 6 months of age, but the ability to understand intentions is only found from around 18 months of age. From the age of three, children are able to refer to mental states using words 'I *thought*',' I *know*' (Shatz, Wellman, & Silber, 1983), and from age five they can understand second-order tasks, which involve the attribution of a belief about another individual's belief (Sullivan, Zaitchik, & Tager-Flusberg, 1994). From age six they are able to predict behaviour based on false beliefs (Baron-Cohen, Leslie, & Frith, 1985). In social terms, these developments in ToM allow children to understand the behaviour of those around them better, leading to less conflict due to misunderstandings. However, it also allows them to be deceitful and manipulate social situations (Hughes & Leekam, 2004). Deficits in an individual's ability to infer the mental states of

others may lead to biased interpretations and cognitive distortions (Keenan & Ward, 2000), which in turn will have a negative impact on the empathic process.

1.1.3. Empathy

The ability to empathise with another person is a multi-step process, and requires an individual to be adept at emotion recognition and perspective taking, as well as being able to experience the appropriate emotion towards the target and offer an appropriate behavioural response (Ward et al., 2000). Barnett and Mann (2013, p. 230) define empathy as "a cognitive emotional understanding of another person's experience, resulting in an emotional response for the observer which is congruent with a view that others are worthy of compassion and respect and have intrinsic worth."

In its simplest form, empathy can be broken down into two core components: cognitive empathy and affective empathy (W. L. Marshall & Maric, 1996). The cognitive component involves identifying the thoughts and feelings of another person, as well as taking their perspective, whereas the emotional component involves sharing the feelings of another person. Singer (2006) suggests that non-overlapping neuro-cognitive circuits are responsible for the different abilities required for the cognitive and affective components of empathy. Additionally, the brain regions relevant to these components are thought to develop at different stages of life, with regions relevant to the affective component developing first (Singer, 2006).

More recent definitions suggest as many as five components, breaking down the cognitive and affective components into more specific parts. Barnett and Mann (2013) argue for a five component definition of empathy which includes emotion contagion, perspective-taking, belief in others' intrinsic worth, the influence of situational factors, and the ability to manage personal distress. These processes work together to produce an empathic response and a deficit in just one component can impair the response. For example, deficits in one's ability to manage personal stress could impair or inhibit an individual's ability to utilise the first two components, as emotional contagion and perspective-taking

can produce distressing feelings that need to be managed effectively to enable an empathic experience (Barnett & Mann, 2013).

As noted previously, being able to recognise facial expressions displayed by others is an essential part of the empathic response. To examine this relationship more closely, Besel and Yuille (2010) conducted a study with a sample of university students. They had participants view facial expressions but varied the length of time the expression was visible. In one condition, participants saw images for only 50ms before they had to choose which emotion was displayed, and in a second condition they had 2,000ms. When facial expressions are presented for a brief time period such as 50ms, rapid judgment is required and occurs unconsciously (Besel & Yuille, 2010). Recognition accuracy was compared with scores on the Empathy Quotient (EQ; Lawrence, Shaw, Baker, Baron-Cohen, & David, 2004) and Empathic Concern subscale of the Interpersonal Reactivity Scale (IRS-EC; Davis, 1983). Results showed that in the 50ms condition, high scores on the EQ were associated with higher recognition accuracy, however IRS-EC scores were a better predictor of recognition accuracy ($\beta = .19$, $p = .04$). Interestingly, this pattern was reversed in the 2000ms condition. This result is not surprising as it is generally accepted that empathy is largely an automatic process (Decety & Jackson, 2006) and this theory would explain why participants who scored highly on measures of empathy were more accurate in the 50ms condition (unconscious processing) but not in the 2,000ms condition (conscious processing).

Facial expressions give us valuable information about how a person is feeling that can allow us to infer their emotional state and share in their emotional experience. Deficits in an individual's ability to create facial expressions may impair the ability of others to infer their emotional state and subsequently empathise with them. In addition, an inability to recognise accurately the facial expressions of others will impair an individual's ability to empathise with them. Occasionally, an individual may want to hide their expressions, and thus prevent others from knowing how they are feeling.

However, this may cause 'leaks' in the form of microexpressions, which would allow others a glimpse at their emotional state.

1.2. Making the link between facial expressions and emotional states

We develop the ability to relate facial expressions to distinct emotional states around 2-3 years of age, although the ability to recognise disgust, surprise, and fear generally takes longer to develop than for happiness and sadness (Gosselin & Simard, 1999). This is due to errors that are commonly made by children in the early recognition of these emotions: disgust is often confused with anger, surprise is often confused with happiness, and fear is often confused with surprise (Gosselin, 1995). Despite these errors, children are able to recognise facial affect at above chance levels. However, they are substantially less accurate than adults and likely do not acquire full recognition proficiency before 10 years of age (Durand, Gallay, Seigneuric, Robichon, & Baudouin, 2007). Durand et al. (2007) tested children in four different age groups (ages 5-6, 7-8, 9-10, 11-12) and adults on their ability to recognise and discriminate between facial expressions. They used both whole (upright and inverted) and composite faces expressing various emotions. The composite faces were made by cutting each photo horizontally through the bridge of the nose, and then pairing each top-half with a bottom-half expressing a different emotion but posed by the same person. Results showed that children were able to recognise happiness and sadness at near adult levels around 5-6 years of age, fear at 7 years, anger at 9 years, and disgust at 12 years of age. However, in virtually all cases, children's ability to discriminate between emotions improved consistently from 5-6 years to adulthood.

Interestingly, it seems that young children have trouble in distinguishing neutral facial affect. While adults tend to categorise ambiguous emotions as either happiness or neutrality, children are not able to recognise the unclear boundaries of neutrality and so categorise ambiguous emotions as either happiness, or sadness (Durand et al., 2007). It was believed that this was due to adults relying on configural processing (e.g. using the relative position of, and the distance between, features) to process facial stimuli, whereas children under

10 years of age were thought to rely more on local information such as features and paraphernalia (Diamond & Carey, 1977). However, the results of Durand et al. (2007) suggest that children under 10 years of age are in fact able to use configural information to process facial emotion in a holistic way, as children also showed both an inversion effect (the impairment of recognition due to a face being upside down) and a composite effect (the impairment of recognition due to a face being made up of the top half of one face and the bottom half of a different face). These two effects are known to interfere with configural processing (Durand et al., 2007).

1.3. Impairments to Recognition Accuracy

Although the ability to recognise facial expressions naturally varies from person to person, there are several identified phenomena that can impair an otherwise healthy individual's ability to read the emotions of others (e.g. brain damage, aging, trauma), which will be discussed below.

1.3.1. Effects of damage to the brain on emotion recognition

Damage to the brain can impede our ability to detect facial affect on the faces of others. Adolphs, Tranel, Damasio, and Damasio (1995) suggest that although bilateral damage to the amygdala generally causes impairment in the recognition of fearful facial expressions, it does not seem to affect recognition of the other emotions. In addition, the ability to draw expressions of fear also appears to be compromised, although this pattern did not emerge for participants with unilateral amygdala damage. However, a study by Calder (1996) suggests that recognition of other emotions (particularly anger) can also be impaired by damage to the amygdala, although impairments in detecting fear were still the most severe. Despite this discrepancy, the two studies did have one finding in common, the ability to infer emotion from facial expressions seems to be independent from the ability to recognise facial identity. However, both studies had only one or two participants with bilateral damage (plus a handful of controls), and each used different experimental methods, thus making

generalisations from, and comparisons between, the two studies difficult. Adolphs et al. (1999) set out to resolve these limitations by testing a group of nine individuals (most of whom had participated in previous studies) with bilateral damage on a single standardised task. The larger sample size allowed for statistical analyses to be performed, and these tests showed that participants with bilateral amygdala damage were the most impaired in their recognition of fear and anger, relative to brain-damaged and normal controls, supporting the conclusions of the previously mentioned studies (Adolphs et al., 1995; Calder, 1996). Adolphs et al. (1999) argued that these results and the results of previous studies suggest that the human amygdala is involved not just in the processing of fearful stimuli, but rather that it is part of a specialised neural system involved in triggering physiological states in the presence of threatening or dangerous stimuli.

1.3.2. Effects of aging on emotion recognition

The natural process of aging can also have a detrimental effect on our ability to accurately identify the emotional states of others. Calder et al. (2003) employed two different experimental designs. In a first experiment, they had participants label faces with one of six emotions, and in a second experiment they had participants label faces morphed between two different emotions for six different emotion pairs (e.g. 90% happiness-10% surprise; the other ratios used were 70-30, 50-50, 30-70, and 10-90). Over the two experiments they found that with increasing age, participants' recognition of expressions of fear became significantly less accurate. Recognition of sadness and anger also showed a decline across age groups. However, recognition of disgust actually improved with increasing age, although this difference was more pronounced with the morphed faces. Calder et al. (2003) suggested that the decrease in recognition of fear was unlikely to be due to an impairment in recognising more difficult emotions as this would also affect the recognition of disgust. Univariate ANOVAs that compared accuracy for all emotions across the five age groups revealed no significant decline in accuracy with age for the other emotions, supporting this conclusion. Kessels, Montagne, Hendriks, Perrett, and Haan

(2014) also found evidence of a decline in emotion recognition over the life span. Using a dynamic morphing procedure, where participants were shown neutral faces that gradually morphed into a random intensity (40, 60, 80, and 100%) of a given emotion, they tested participants ranging from 8-75 years of age. Specifically, they found that recognition of anger, fear, sadness, and happiness was negatively correlated with age, with accuracy for all emotions peaking at 26-35 years of age and then declining slowly from ages 36-75.

These studies are supported by a meta-analysis of 15 published studies carried out by Ruffman, Henry, Livingstone, and Phillips (2008). In all, there were 28 data sets gathered between 1995 and 2008, containing 1,667 participants. In their analysis, they found older adults (mean age 70.2 years) were significantly less accurate than younger adults (mean age 23.9 years) at recognising expressions of anger, sadness, and fear (mean d = .34, .34, and .27 respectively), as well as happiness and surprise although these differences were much smaller (d = .08, and .07 respectively).

In contrast, Boshyan, Zebrowitz, Franklin, McCormick, and Carré (2013) investigated age similarities in recognizing threat from faces and diagnostic cues. The participants were divided randomly into three conditions: experimental, distraction, and accuracy. In the experimental condition, participants were told to rate a series of faces based only on their first impressions and not to be concerned about accuracy. In the distraction condition, participants were instructed as per the experimental condition. However, a random three-digit number would appear on the screen for 1s prior to the appearance of each face. Participants were asked to count backward out loud from that number by three while they viewed the face and to stop counting when the rating scale appeared. In the accuracy condition, participants were given much more information about the experimental design and told: “As you are rating these men, please keep in mind that they actually do vary in how aggressive they were when provoked, and judge as accurately as you can” (Boshyan et al., 2013, p.2-3). Analyses revealed no significant main effects (participant age, condition) and the interaction of age and condition was also not significant. Planned comparisons also revealed no significant differences between the two age groups within each condition.

Ebner and Johnson (2009) examined whether age-related deficits in emotion recognition were affected by the age of the face expressing the emotion. They tested university students (mean age 19.3 years) and older adults from the community (mean age 74.8 years) using two tasks. In the first task, participants were shown faces expressing happiness, anger, or no emotion (neutral). Faces were displayed for 5s each and participants were only required to respond as to which emotion they had seen from four options: happiness, anger, neutral or other. The faces used in the task came from the FACES database (Ebner, Riediger, & Lindenberger, 2010) and belonged to one of two age groups (18-31 years and 69-80 years). In a second task, participants were shown the same faces (as well as 24 new faces) and had to say whether or not each face had been displayed in the previous task, and how certain they were of their decision on a scale of 1 (not certain at all) to 4 (very certain). Consistent with the previously mentioned studies (Calder et al., 2003; Kessels et al., 2014; Ruffman et al., 2008), older adults (OA) were poorer at recognising angry faces than younger adults (YA), but the two groups did not differ in their recognition of happy and neutral faces. However, this may partly be due to low participant numbers and therefore low statistical power. In addition, both OA and YA were more accurate in recognising emotion in young faces than older faces. However, this may well be due to the physical changes associated with aging (e.g. wrinkles) which make it harder to detect the subtle muscle movements necessary to identify an emotional expression (Ebner & Johnson, 2009). Finally, YA performed significantly better on the memory task, showing higher accuracy overall and no differences due to emotion. In contrast, OA were significantly poorer at remembering angry faces than they were at remembering happy faces. This result in particular points towards a positive emotion bias in OA and this will be discussed in a separate section.

Overall, research suggests a steady decline in emotion recognition accuracy over the lifespan; OA frequently perform poorer on recognition tasks than YA, especially when identifying expressions of anger and fear. In addition, it seems as though emotions are easier to recognise in younger faces than older faces. The present study will take this one step further than Ebner and Johnson (2009) by using photos of children displaying emotions as well as adults.

1.3.3. Effects of childhood trauma on emotion recognition

Finally, traumatic experiences during childhood can alter the way we interpret and understand emotional stimuli. Pollak, Cicchetti, Hornung, and Reed (2000) tested three groups of children (neglected, physically abused, and a control group) on their ability to identify and discriminate between emotions. The children were individually presented with brief evocative accounts in which a protagonist experienced either happiness, fear, sadness, disgust, or anger. Following this, the children were shown three black and white photographs of models (of the same sex as the child) each expressing a different emotion and were asked which face was expressing the same emotion as the protagonist in the story. Pollak et al. (2000) found that control children performed significantly better on the task than both abused and neglected children (accuracy scores of 66%, 59%, and 51% respectively). Post-hoc analyses of a significant interaction between maltreatment group and emotion revealed that the accuracy scores were significant for anger and sadness. For angry expressions, neglected children's recognition accuracy was significantly lower than both physically abused and control children. For sad expressions, physically abused children performed significantly worse than controls, but not neglected children. In addition, both control and physically abused children were able to discriminate between emotions more accurately than neglected children. Neglected children also showed a liberal response bias for sad faces, which is particularly interesting considering their below chance accuracy for correctly recognising this emotion (accuracy <40%). Physically abused children also showed a liberal response bias, although this was towards angry faces, and this was reflected in their high recognition accuracy for this emotion (accuracy >70%). It is possible that these biases arise from the emotions that neglected and abused children are likely to have experienced frequently due to their adverse circumstances. Shenk, Putnam, and Noll (2013) found that in female adolescents, maltreatment (in this case mainly physical and sexual abuse) interacted with level of intellectual functioning to predict recognition accuracy. Whereas maltreated females with low levels of intellectual functioning were the least accurate, maltreated females with high levels of intellectual functioning performed as well as non-maltreated

females. However, maltreated females were significantly less accurate at recognising fear than non-maltreated females.

The findings of these studies suggest that there is an interaction between childhood trauma and the ability to recognise and interpret emotional stimuli. This is an important point to consider when examining emotion recognition abilities, as deficits in recognition may be explained by traumatic events in the individual's past.

1.4. Biases in Emotion Recognition

Research has also provided evidence that older adults (OA) tend to show a positivity bias (i.e. they label negative emotions as positive) towards negative stimuli (Mather & Carstensen, 2005) compared with younger adults (YA), although this is a small effect (Murphy & Isaacowitz, 2008). A study by Ruffman, Sullivan, and Edge (2006) found that OA and YA differed in how they discriminated between high- and low-danger faces; interestingly, this difference was not present when rating situations instead of faces. More specifically, OA rated high-danger faces as less of a threat than YA did, although the two groups did not differ when rating low-danger faces. Zebrowitz, Franklin Jr, Hillman, and Boc (2013) also found evidence for a positivity bias in OA. In their study, OA and YA rated a set of faces on four traits (competent, healthy, untrustworthy, and aggressive or hostile). They found that OA trait impressions of health, untrustworthiness, and hostility showed greater positivity than those of YA. In addition, these differences were far more pronounced for more negative looking faces, with little difference between the two groups for the less negative faces at the lower end of the untrustworthy and hostile traits. Finally, Kellough and Knight (2012) used a morphing procedure (i.e. morphing two faces together to create a continuum from one emotion to the other) and found that OA positivity effects were dependent on the ambiguity of the expressions presented to them. Specifically, OA perceived both negative and ambiguous expressions to be more positive than YA, and in addition, OA perceived negative emotions to be more complex than YA (that is, OA saw both positive and negative emotions in these faces). Interestingly, manipulating older adults' time perspective effectively

reduced the positivity effects discussed above. This was done by giving OA the following instructions before the start of the procedure: "Imagine that last week you found out from your doctor about a new medical advance that insures you will enjoy 20 more years beyond the age you expected to live, in reasonably good health" (Kellough & Knight, 2012, p.153). An expanded time perspective may allow OA to more fully process negative affect and focus less on maintaining a positive mood. In contrast to these studies, Ruffman et al. (2008) did not find evidence for a positivity bias in OA in their meta-analysis. In fact, they found that OA were less accurate than YA when labeling expressions of happiness, and more accurate than YA when labeling expressions of disgust. Both of these findings are inconsistent with a positivity bias in OA.

Regardless, if OA are indeed more likely to show a bias towards positive emotions, then it is possible that older child sexual offenders will be even more at risk of doing so, as it is not uncommon for child sexual offenders to incorrectly interpret negative facial expressions as sexual advances or pleasure, or to ignore them completely (Ward, Hudson, Johnston, & Marshall, 1997). This process of selective attention allows the offender to justify his actions as pleasurable for the victim, as he has no information that would suggest otherwise. This could result in negative outcomes for older released offenders due partly to poor emotion recognition, which is something that can be improved with training.

1.5. Child sexual offenders and emotion recognition

Child sexual offenders are an important group for research due to the impact their offending has on their victims and society at large. However, the literature on the emotion recognition abilities of child sexual offenders is currently not as extensive as other areas of sexual offender research, and thus requires more investigation.

1.5.1. Deficits in theory of mind and cognitive distortions

Distorted thinking about their victims and potential victims plays a large part in the origin and maintaining of child sexual offenders' abusive behaviour.

In addition, many offenders fail to understand the distress their victims experience, as well as lacking in their ability to form and manage intimate and interpersonal relationships with adults (Keenan & Ward, 2000). Ward et al. (2000) suggest that deficits in an offender's ability to infer the mental states of others (or their theory of mind) may contribute to these deficits in empathy and intimacy, as well as contributing to the development of cognitive distortions. They also suggest that theory of mind deficits are likely to be common amongst sexual offenders.

Castellino, Bosco, Marshall, Marshall, and Veglia (2011) tested both sexual offenders (child molesters and rapists) and non-offenders on their ability to complete first-order, second-order, and advanced theory of mind (ToM) tasks. First-order ToM tasks involve attributing a false belief about the identity or location of an object to another individual. Second-order ToM tasks involve attributing an individual's false belief about another individual's belief. Advanced ToM tasks involve attribution of mental states such as desires, beliefs or intentions, and sometimes one character's belief about what another character knows. Castellino et al. (2011) found that while sexual offenders performed as well as non-offenders on first order ToM tasks, they performed worse on second-order and advanced ToM tasks, and a Theory of Mind Assessment Scale (Th.o.m.a.s; Bosco et al., 2009). *Th.o.m.a.s* consists of four subscales: I-Me (awareness of my own mental states), Other-Self (awareness that other people can reflect on their own mental states), I-Other (awareness that I can reflect on the mental states of others), and Other-Me (awareness that other people form ideas about my own mental states). The sexual offenders performed worse than non-offenders on each of the Th.o.m.a.s subscales. In particular the offenders performed worse on the Other-Self scale than the I-Me and I-Other scales (non-offenders performed equally well on all three scales). This suggests the offenders found it more difficult to make third-person judgments about mental states than first-person judgments, and that they found it even harder to do so from an allocentric perspective (other focused) than an egocentric perspective (I focused). Intelligence (IQ) was not significantly correlated with total scores on either the classical ToM tasks (first-order, second-order, and advanced) or the Th.o.m.a.s. Elsegood and Duff (2010) also

found deficits in sexual offenders' ToM skills using the Reading the Mind in the Eyes test (RME; Baron-Cohen et al., 2001), with both adult and child faces. The RME requires participants to make judgments about the mental states of others, based solely on a photograph of their eyes. Elsegood and Duff (2010) found that overall, sexual offenders performed worse on both the adult and child tasks than non-offenders, although only the difference in adult task scores was significant. On the adult task, 15.2% of offenders scored more than two standard deviations (SD) below the normative mean (M = 26), compared with 4.3% of non-offenders. On the child task, 6.5% of offenders scored more than two SDs below the normative mean (M = 19), compared with 2.2% of non-offenders [a score more than two SDs below the normative mean suggests a clear impairment on the task (Elsegood & Duff, 2010)]. Offenders' scores on the adult task were also significantly correlated with their scores on the child task (r = .46, p < .01); interestingly, this relationship was not found with non-offenders.

Cognitive distortions include beliefs and attitudes that are maladaptive, as well as problematic thinking styles (Ward, 2000), although Ward and Casey (2010) suggest that the term "incorrect or deviant cognitive practices" should be used in its place. Abel and colleagues (Abel, Becker, & Cunningham-Rathner, 1984; Abel et al., 1989) argued that cognitive distortions arise from a conflict between their perception of social norms and their sexual preferences. The offenders then maintain their offending through these distorted beliefs that serve to legitimise their sexual contact with children. Ward and Casey (2010) propose that the extended mind theory (EMT) provides a superior explanation of sexual offenders use of cognitive distortions. From the standpoint of EMT, cognitive distortions are dynamic, dependent on context, and include both internal and external components. The key idea of EMT suggests that the skin of the individual does not limit the mind, or the cognitive processes that it is composed of. That is to say, our cognitive systems are capable of reaching beyond our own self, into our social and physical environments (Wilson & Clark, 2009). For example, a note written on a piece of paper could be seen as an extension of the individual's cognitive system (O´ Ciardha & Ward, 2013).

1.5.2. Empathy and emotion recognition of child sexual offenders

It has been noted that sex offenders may lack the ability to empathise with their victims, although they are thought to be able to empathise with people in general (William L. Marshall, Marshall, Serran, & O'Brien, 2009). In addition, feelings of guilt and shame can also have an impact on an individual's ability to empathise with others (William L. Marshall et al., 2009; Proeve & Howells, 2002), and self-esteem may be highly correlated with both of these (Sparks, Bailey, Marshall, & Marshall, 2003). In particular, Sparks et al. (2003) found that self-esteem was significantly related to the tendency of offenders' to externalise blame and minimise aspects of their crimes. Therefore, it seems reasonable to suggest that a lack of empathy in sexual offenders may be due to low self-esteem, which in turn can produce feelings of shame (William L. Marshall et al., 2009). Barnett and Mann (2013) suggest that each of their five components of empathy can be disrupted by certain dynamic risk factors for sexual offending, thus impairing an offenders' ability to produce an empathic response at the time of an offence. These risk factors include: offence supportive beliefs, grievance/hostility, a lack of concern for others, self-regulation problems, sexual preoccupation, and poor problem solving. Barnett and Mann (2013) also suggested that addressing these dynamic risk factors by focusing on increasing empathy for past victims may not affect an offenders' ability to empathise with potential victims in the future. Thus, treatment programmes should focus on general applications of the five components of empathy and not just particular past victims.

Gery et al. (2009) compared recognition accuracy to scores on several self-report measures of empathy for offenders and non-offenders. They found that non-offenders scored significantly higher on all these measures than offenders (sex offenders and non-sex offenders combined). In addition, Sex offenders scored significantly lower than non-sex offenders and controls on the Empathy subscale of the Impulsivity-Venturesomeness-Empathy-7 questionnaire (ES-IVE-7; Eysenck, Pearson, Easting, & Allsopp, 1985), whereas non-sex offenders did not differ from controls. Hudson et al. (1993) also found

that non-offenders scored significantly higher on the Interpersonal Reactivity Index (IRI) than child sexual offenders. There were also significant positive partial correlations (pr) between scores on the ES-IVE and recognition accuracy for fear (pr = .45) and disgust (pr = .56). No significant correlations were found between emotion recognition and the Fantasy (FS), Empathic Concern (EC), or Perspective Taking (PT) subscales of the Interpersonal Reactivity Index (IRI). However, significant negative correlations were found between the Personal Distress (PD) subscale of the IRI and surprise (pr = -.43), and anger (pr = -.48). In contrast, Hudson et al. (1993) found that accuracy of emotion recognition with child stimuli was significantly positively correlated with the FS (r = .62), EC (r = .64), and PT (r = .49) subsacles of the IRI, but not the PD subscale. Participants who scored higher on measures of empathy were more accurate at recognising emotions in children, but this effect was not observed with adult stimuli in either study. These results suggest that offenders are less empathic than non-offenders, which in turn would indicate that non-offenders should be more accurate at recognising emotions, both in adults and children.

Robinson et al. (2012) tested emotion recognition in a sample of Scottish offenders (only 17.2% were sexual offenders, however there were no significant differences between offender groups for the emotions of fear and anger) and found that fear was the least accurately recognised emotion (average of 4.2 correct responses out of 10). In addition, the offenders were much better at recognising anger (average of 6.3 correct responses out of 10).

1.5.3. Emotion recognition abilities of child sexual offenders

Hudson et al. (1993) tested 75 offenders (11 of whom had committed sexual offences against children) on their ability to discriminate between facial expressions, using Ekman and Friesen's pictures of facial affect (Ekman & Friesen, 1976), and found that sexual offenders performed significantly poorer than the other groups of offenders on the task. More specifically, sexual offenders most often mistook expressions of fear for surprise, and their recognition of fear was lower than for the five other emotions. Hudson et al. (1993) suggested that this mistake may serve to facilitate offending, rather than

inhibit it; being that fear is a negative emotion, whereas surprise is mostly positive, an offender could mistake a frightened child for a child who is interested in sexual activity without knowing their error. In a second study, Hudson et al. (1993) examined child sexual offenders' ability to recognise emotional states in children, relative to a group of non-offender controls. To do this, they used the Emotional Expression subset of the Test of Social Intelligence (O'Sullivan & Guilford, 1976). This test contains line drawings of adults and so Hudson et al. (1993) employed a local artist to produce a matching set of drawings with child faces. The child drawings were then tested for accuracy against the adult drawings with a sample of university students. Only images that were accurately identified by the majority of the students were used. For this study the participants were 20 male non-familial sexual offenders against children with female victims and 20 male community controls. The participants had to identify the emotion expressed in each image, from a selection of four responses. Offenders were significantly less accurate than non-offenders at recognising emotions in both adults and children, although they had no specific deficit for recognising emotions in children. However, the stimuli used in this study were not ideal. While the line drawings could be accurately identified by students, they were not tested on offenders prior to the study. In addition, Hudson et al. (1993) did not provide accuracy data for this study so it is not possible to know how accurate both offenders and non-offenders were, only that non-offenders were significantly more accurate. Given that the literature points towards a general deficit in the emotion recognition of sexual offenders, it is possible that the offenders would struggle more with drawings of emotion than they would with photographs. The present study aims to address this limitation by using high quality photographs from a standard set with both adult and child models (Radboud Faces Database; Langner et al., 2010). In addition, Hudson et al. (1993) had low participant numbers and this could be a cause of the lack of significant differences between participants' recognition of adult and child faces.

Gery et al. (2009) tested child sexual offenders' ability to recognise emotions at varying intensities. They found that sex offenders (in particular, child molesters) were less sensitive in recognizing the facial expressions of fear and surprise (often confusing the former for the latter) than non-sex offenders

or normal controls. In fact, their recognition accuracy of fearful facial expressions was less than 10% at 40% and 100% intensity of the emotion, and they could not recognise it at all at 70% intensity, whereas non-sex offenders and controls were able to recognise these emotions at 75-100% accuracy for all intensities. Sex offenders' recognition of surprise was much better but not above chance levels at any intensity. The differing intensity levels were made using face morphing software that combined different amounts of neutral and emotional faces. However, like Hudson et al. (1993), Gery et al. (2009) likely had low statistical power due to a small sample size. In addition, their use of the signal detection measure d' was questionable because their experimental design used a forced-choice with seven alternatives. The use of standard formulas for d' is only appropriate for two-alternative forced choice (2AFC) procedures (Stanislaw & Todorov, 1999).

In contrast, a study by Oliver, Watson, Gannon, and Beech (2009) suggests that even when sexually primed, sex offenders are able to accurately recognise fear in photographs of individuals. Oliver et al. (2009) used a computer-based task to investigate the emotional recognition skills of 23 male child sexual offenders. The experiment consisted of two phases (prime and probe) and measured both response time and error rates to facial expressions of surprise and fear, presented using Ekman and Friesen's pictures of facial affect (Ekman & Friesen, 1976). The priming phase of the experiment consisted of the presentation of short phrases via computer of either sexual (e.g. "You caress her nipple") or neutral (e.g. "You brush your teeth") content. The probe phase of the experiment consisted of the presentation of adult facial expressions depicting either the emotion fear or surprise. Oliver et al. (2009) found that overall, the recognition rates of the child sex offenders were slightly lower than a control group of non-offenders, although this difference was not significant. However, when sexually primed, the child sex offenders became significantly more accurate at recognizing fear and less accurate at recognizing surprise. The same pattern emerged for the non-offenders, although the magnitude of this change was not significant. The child sex offenders were also faster at recognizing fearful facial affect under the sexual priming condition relative to the neutral priming condition. Oliver et al. (2009) suggested that although child sex

offenders may be better at recognizing fear in their victims when sexually aroused, it is possible that they actively filter out this sign of distress, or simply fail to attend to it. It may also be the case that the offenders "…have developed a cognitive association between the concepts of sex, children, and arrest that has left them hypervigilant and more susceptible to recognizing fearful affect…" (Oliver et al., 2009, p.302) when sex related concepts are activated. Nevertheless, these results highlight an important issue that warrants further investigation, and certainly supports studies that have found empathy deficits in child sexual offenders. However, like Gery et al. (2009), the Oliver et al. (2009) study suffers from several limitations. Namely, Oliver et al.'s results did not reach significance and their sample size was small (23 offenders and 26 controls). Thus, it is difficult to generalise from their results to the population they sampled. In addition, while empirically validated, Ekman and Friesen's pictures of facial affect (1976) are relatively low quality, black and white images and arguably do not provide an accurate representation of faces seen during an offender's day-to-day life.

Although the literature on the emotion recognition abilities of child sexual offenders is not extensive, several studies that have been conducted suggest that sexual offenders likely have deficits in their emotion recognition abilities. However, it is also possible that when sexually aroused, offenders may actually become more sensitive to recognising fear in potential victims. This result is particularly concerning, as it would imply that offenders are aware of the distress of their victims while committing an offence. Nevertheless, more research is needed to gain a better understanding about the recognition abilities of child sexual offenders, and to determine whether training in this area would be a worthwhile addition to treatment programmes.

1.6. Summary and present study

Given the high cost of sexual offending, both to the victims and society at large, it is reasonable to pursue any avenue that could lead to a reduction in re-offending, or a drop in first offences. Previous research has suggested that child

sexual offenders may have deficits in recognising facial affect in adults relative to non-offenders, however, besides the Hudson et al. (1993) study, this research has not examined child sexual offenders' ability to recognise emotions in children. This is an interesting gap in the research literature considering that these offenders victimise children. In addition, previous research has suffered from low participant numbers and thus these studies would have low statistical power, which reduces the chance of finding legitimate significant differences.

Therefore, the present study aims to build upon previous research on emotion recognition with sexual offenders by addressing some of the limitations in prior studies. Namely, we plan to use a larger sample of child sex offenders and non-offenders, as well as to examine both groups' recognition of facial affect in children. We will also seek to obtain information about psychopathic personality traits and IQ, as Oliver et al. (2009) suggested a potential link between these variables and recognition ability may be present. In addition, we will be creating stimuli by morphing two emotional faces together to create a continuum from the first emotion to the second in 10% increments. This morphing procedure has been used in several studies, including studies with offenders (e.g. Jusyte & Schönenberg, 2014; Pollak & Kistler, 2002; Pollak & Tolley-Schell, 2003; Schönenberg & Jusyte, 2014). We are also able to test participants' responses to ambiguous facial expressions, as research suggests that aggressive individuals are more likely to attribute ambiguous expressions as hostile (Schönenberg & Jusyte, 2014). Finally, we will use a two-alternative forced choice (2AFC) procedure to allow us to analyse the results using signal detection measures, which will provide separate measures of bias and discriminability.

Our aims for this research are as follows:

1. To compare the accuracy of sexual offenders' judgments of emotions in adult and child faces, and determine if there are deficits relative to a control group of non-offenders.
2. To determine whether child sex offenders show more bias towards positive emotions than a comparable group of non-offenders.

3. To determine whether child sex offenders show a specific deficit when discriminating between emotions in children than a comparable group of non-offenders.

Method

2.1 Participants

The sample of participants consisted of two groups: child sexual offenders and non-offenders. Altogether 49 male child sexual offenders and 46 male non-offenders completed the experiment.

2.1.1 Child Sexual Offenders

All child sexual offenders were residing at the Kia Marama (N = 42) and Totara (N = 7) Units at Rolleston Prison in Christchurch, New Zealand. These are both special treatment units (STU) for sexual offenders against children. Of the child sexual offenders: 4 men had yet to undergo treatment, 14 men were currently undergoing treatment, and 29 men had completed treatment and were participating in a graduate's consolidation programme. The average age of the offenders was 46.37 years (SD = 13.29 years, range = 21-72). Of the sample, 61.22% identified as Pākehā, 30.61% as Māori, and 8.16% as Other.

2.1.2. Non-Offenders

The sample of non-offenders was obtained from both a selection of university students (N = 29), and members of the community who were not currently attending an educational institution, or had already graduated from one (N = 17). The students' sample was made up of both first year students participating for course credit, and older students participating for an incentive. The average age of the student sample was 20.64 years (SD = 2.59, range = 18-28 years) and the average age of the community sample was 34.18 years (SD = 16.01, range = 22-67 years). Overall, the average age of non-offenders was 25.67 years (SD = 11.61). Of the sample, 76.09% identified as Pākehā, 2.17% as Māori,

and 21.74% as Other.

2.2 Procedure

Participants were informed about the study and given an opportunity to consent, or decline to participate. Participants that consented completed the facial affect recognition task and non-offenders received $10 compensation for their participation. Participants were seated in front of a computer screen (22" Philips monitor for non-offenders, and a 15" laptop for offenders). Offenders then proceeded straight to the recognition task, however, non-offenders first completed the Levenson Self-Report Psychopathy Scale (LSRP; M. R. Levenson, Kiehl, & Fitzpatrick, 1995). In the first stage of the recognition task, participants answered a series of demographic questions about their age, ethnicity, occupation (before arrest for offenders), and highest level of education.

2.2.1 Facial Affect Recognition Task

The experimental procedure was built in E-Prime (E-Prime 2.0, Psychology Software Tools Inc., Sharpsburg, PA, USA). The facial affect recognition task consisted of six blocks of trials, each block consisting of 40 trials. Figure 1 shows the steps of a typical trial. Each trial began with the presentation of a fixation cross for 500ms. Participants were then presented with a morphed face for 1.5s before the option to respond was available. In each block, responses were a forced choice between 2 different emotions (selected from sadness, anger, happiness, and fear). Participants had as long as they needed to make their choice, however they were encouraged to make quick decisions. At the start of each block, participants were presented with four practice trials of full emotions (no morphs were used for practice trials), two for each of the emotions in that block posed by one randomly selected model from each age group and sex (1 man, 1 woman, 1 boy, and 1 girl). These practice trials were to orient the participant to the two emotions that were to be discriminated between in that block, as well as to familiarise them with the experimental design. Between trials, a 1.5 second delay was presented in the form of a blank

screen. Participants were able to take a break between blocks if they wished but were asked to remain seated for the duration of the procedure. There was no fixed time limit for the task; completion times ranged from 25 to 60 minutes.

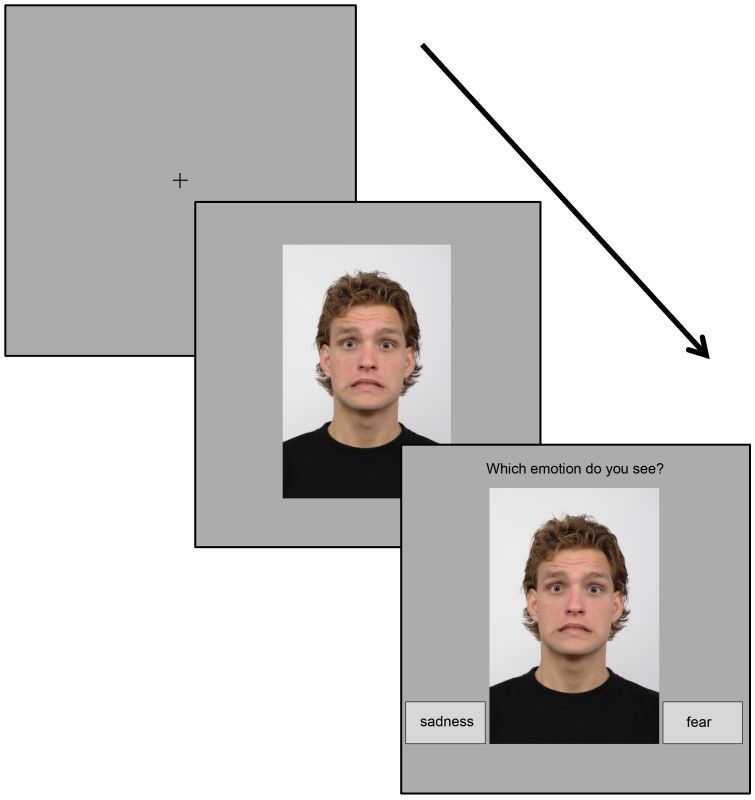

Figure 1. Step by step process of a typical trial

2.3 Measures

2.3.1 Descriptive measures

The highest level of education was measured on an eight-point scale: Primary School = 1; Secondary School without School Certificate or NCEA = 2; School Certificate/NCEA Lv1 = 3; Sixth Form Certificate/NCEA Lv2 = 4; Bursary/NCEA Lv3 = 5; Technical or Trade Qualification = 6; University Graduate = 7; and Postgraduate Qualification = 8. Occupation was used to measure socio-economic status (SES) according to the Australian and New Zealand Standard Classification of Occupations (ANZSCO) and the New Zealand Socio-Economic Index (NZSEI-06; Milne, Byun, & Lee, 2013). Occupations were first classified as belonging to one of eight major groups: managers,

professionals, technicians and trades workers, community and personal service workers, clerical and administrative workers, sales workers, machinery operators and drivers, and labourers using the ANZSCO classifications and then assigned an SES score using the NZSEI-06. NZSEI-06 scores range from 10 (lowest) to 90 (highest). SES scores for offenders were determined based on their occupation prior to their arrest.

2.3.2 Model selection

Models were selected from the Radboud Faces Database (RaFD; Langer et al., 2010) at random. The RaFD database contains thousands of images of 67 models (Caucasian males and females, Caucasian children, and Moroccan Dutch males) photographed displaying 8 emotional expressions (anger, fear, sadness, happiness, disgust, surprise, contempt and neutral). Models were photographed wearing black t-shirts, facing front on, and set against a neutral background. For this experiment, six adult actors were randomly selected from each sex and four children were also randomly selected from each sex (6 women, 6 men, 4 boys, and 4 girls). Two Moroccan males were selected, as a set of emotional faces using New Zealand Māori models was not available.

2.3.3 Morphs

The morphing software Fantamorph 2.4.2 (Abrosoft Inc, Beijing, China) was used to create the morphed images. Emotional expressions were morphed through 10 steps from the first to second emotional expression, allowing for static images to be created in 10% increments of the second emotion (e.g. 80% happiness, 20% sadness). Figure 2 shows a typical continuum from 90% sadness to 90% anger, with 50% being an equal combination of the two emotions, which provided a reasonably ambiguous expression. Full expressions (100%) were not used in the experimental trials as accuracy of recognition at this point was expected to be around 100%, which would not add any useful data to the analyses. All morphed images used in this study can be found in Appendix A.

2.3.4 *Psychometrics*

We obtained scores on the Wechsler Abbreviated Scale of Intelligence (WASI; Wechsler, 1999), for all offenders. Non-offenders completed the Levenson Self-Report Psychopathy Scale (LSRP; M. R. Levenson et al., 1995), which has been shown to be a valid measure of psychopathy and well as correlating reasonably well with the PCL-R (Lynam, Whiteside, & Jones, 1999; Walters, Brinkley, Magaletta, & Diamond, 2008). The LSRP is a 26-item self-report survey designed for non-incarcerated populations consisting of two factors: primary psychopathy (affective aspects of psychopathy e.g. lack of empathy) and secondary psychopathy (antisocial aspects of psychopathy e.g. rule breaking).

2.3.5 Definitions

For the purpose of this experiment, the definitions of fear, happiness, sadness, and anger are as follows (taken from Ekman & Cordaro, 2011):

- Fear – The response to the threat of harm, physical or psychological. Fear activates impulses to freeze or flee. Often fear triggers anger.
- Happiness - Feelings that are enjoyed, that are sought by the person. There are a number of quite different enjoyable emotions, each triggered by a different event, involving a different signal and likely behaviour.
- Sadness - The response to the loss of an object or person to which you are very attached. The prototypical experience is the death of a loved child, parent, or spouse. In sadness there is resignation, but in can turn into anguish in which there is agitation and protest over the loss and then return to sadness again.

Anger - The response to interference with our pursuit of a goal we care about. Anger can also be triggered by someone attempting to harm us (physically or psychologically) or someone we care about. In addition to removing the obstacle or stopping the harm, anger often involves the wish to hurt the target.

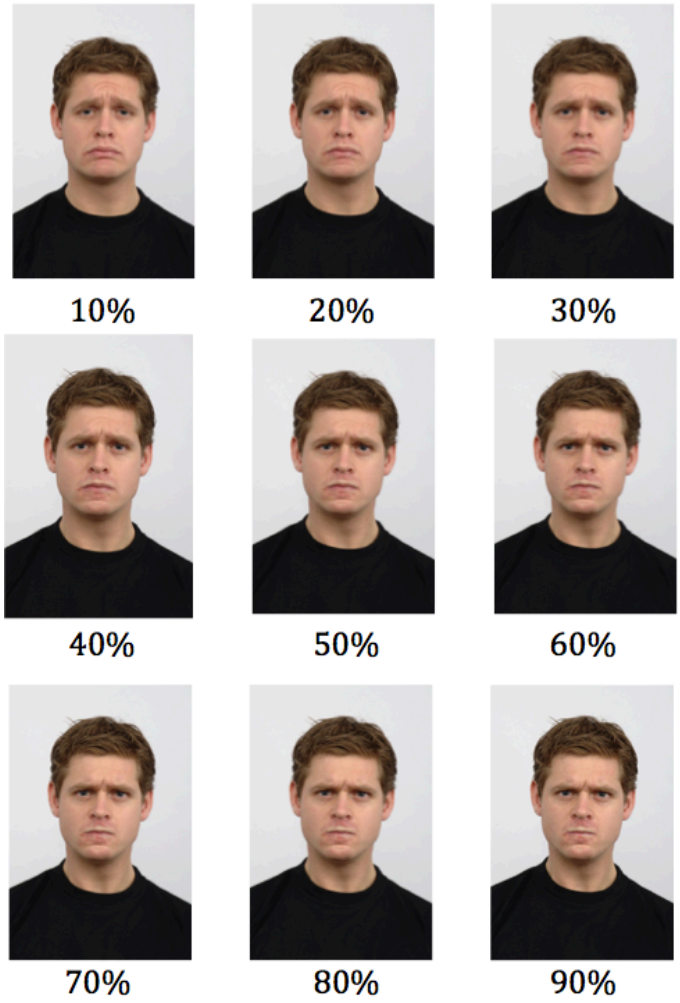

Figure 2. A continuum from sadness to anger in 10% increments.

2.4 Planned Data Analyses

First, we compared demographic information on age, ethnicity, occupation (prior to arrest for offenders), and level of education between offenders and non-offenders. Response data was used to calculate accuracy scores, as well as measures of discriminability and bias according to Stanislaw and Todorov (1999). To measure accuracy, correct responses for each emotion pair were calculated as responses to the dominant emotion (e.g. for a morph of sadness and happiness containing 67% or 80% sadness, sadness would be the correct response). Responses to 50% morphs were excluded from accuracy scores. Accuracy scores were first compared for each emotion pair across

blocks of eight trials (five blocks or 40 trials per emotion pair) using a repeated measures ANOVA with group as a between-subjects factor and block as a within-subjects factor. An omnibus analysis across emotion pairs was also conducted, again with each emotion pair spilt into blocks of eight trials, with group as a between-subjects factor and emotion pair and block as within-subjects factors. The purpose of this analysis was to assess how responding changed over the course of each emotion pair (i.e. training effects), and whether any differences between the groups were independent of block. Our plan was to aggregate responses across blocks to calculate the signal detection measures, but wanted to make sure that any effects of training were similar for offenders and non-offenders.

Next we conducted signal detection analyses to provide separate measures of bias and discriminability. Bias indicates a general tendency to respond to one alternative over the other, whereas discriminability measures the extent to which the alternatives are correctly identified. Bias scores were calculated with the formula:

$$\beta = e^{\left\{\frac{[\Phi^{-1}(F)]^2 - [\Phi^{-1}(H)]}{2}\right\}^2} \quad [1]$$

Where *H* and *F* are hit rate and false alarm rate respectively. Discriminability scores were calculated with the formula:

$$d' = \phi^{-1}(H) - \phi^{-1}(F) \quad [2]$$

Bias and discriminability scores were analysed in the same way, again by emotion pair. Discriminability scores were also analysed in an omnibus fashion, again with group as a between-subjects factor. However, emotion pair was used as a within-subjects factor as well as age (adult, child) and sex (male, female) of model. We then conducted an ANCOVA with age, education and SES as covariates, where significant group differences had emerged to determine if demographic differences between the two groups could explain differences in responding. Finally, we examined the relationship between responding in the emotion task and measures of psychopathic personality and IQ. However, this analysis was limited as we were only able to obtain psychopathy scores for non-offenders and IQ scores for offenders.

Results

3.1 Demographics

Table 1 presents demographic information for the offender and non-offender groups. Multiple *t*-tests were conducted with Bonferroni correction to assess between-group differences. As can be seen in Table 1, offenders were significantly older (M = 46.37 years) than non-offenders (M = 25.67), $t(93) = 8.06$, $p < .001$, $d = 1.66$, and had both lower levels of education and SES than non-offenders, $t(93) = 10.93$, $p < .001$, $d = 2.25$; and $t(93) = 6.29$, $p < .001$, $d = 1.28$ respectively. The possible contribution of these variables to any potential differences in the Emotion Recognition Task between offenders and non-offenders is considered below.

Table 1.

Demographic data for all groups. (Standard deviations in brackets).

	Offenders (N = 49)	Non-Offenders (N = 46)	*t*	*p*
Age	46.37 (13.29)	25.67 (11.61)	8.06	<.001
Education	2.67 (1.55)	5.98 (1.39)	-10.93	<.001
Socioeconomic Status	34.08 (10.87)	49.91 (13.79)	-6.29	<.001

3.2 Emotion Recognition Task - Accuracy

Accuracy scores for the Emotion Recognition Task were calculated based on the assumption that the majority emotion for non-50% morphs was the correct response (e.g. in the happy/sad pair, a correct response would be 'happy' to faces containing less than 50% sadness, and 'sad' to faces containing more than 50% sadness. Responses to 50% morphs were not counted). Accuracy scores for each emotion pair were computed separately for each block of 8 trials (with 40 trials = 5 blocks for each emotion pair).

Accuracy by emotion pair and block

First we analysed responding across emotion pairs for both offenders and non-offenders, to determine whether responding differed across these pairs. A repeated-measures ANOVA, with group as a between-groups factor, and block and emotion pair as within-groups factors confirmed that a significant main effect of emotion pair was found, $F(5,465) = 27.72$, $p < .001$, $\eta_p^2 = .23$, indicating that levels of accuracy differed across emotion pairs. A significant effect of Block was also found, $F(4,372) = 11.78$, $p < .001$, $\eta_p^2 = .11$, as accuracy increased by approximately 5% from the first to last block of eight trials (81.08% - 86.30%). This suggests that participants were reasonably adept at the task overall, although they performed better in the final three blocks of each emotion pair. There was no main effect of group ($p = .12$), and no interaction of block and group ($p < .40$), emotion pair and group ($p = .09$), or emotion pair, block and group, suggesting that both offenders and non-offenders showed a similar pattern of improvement over the five blocks of each emotion pair.

Because there was a significant main effect of emotion pair, we also analysed responding separately for each pair. Figure 3 shows accuracy scores for both groups across the five blocks of trials in each emotion pair, and mean accuracy scores for each pair are displayed in Table 2. Overall, both offenders and non-offenders showed similar levels of accuracy for each emotion pair, with no significant main effects or interactions involving group, with the exception of Fear-Anger. As can be seen in the centre right panel of Figure 2, non-offenders ($M = 83.71\%$) were overall more accurate than offenders ($M = 78.77\%$), although the main effect of group just failed to reach significance, $F(1,93) = 3.80$, $p = .054$. Also evident in this emotion pair is a relatively sharp decline in offenders' accuracy in blocks three ($M = 76.54\%$) and four ($M = 74.25\%$), followed by an increase in block five ($M = 82.29\%$). A repeated measures ANOVA was conducted with group as a between-groups factor and block as a within-groups factor. A significant main effect of block was found in the Fear-Anger emotion pair, $F(4,372) = 2.60$, $p = .036$, $\eta_p^2 = .03$, but the interaction of block and group was not significant ($p = .46$).

There were no significant main effects of group (all *p*s < .10), and no interactions of block and group (all *p*s < .30) in any of the other emotion pairs.

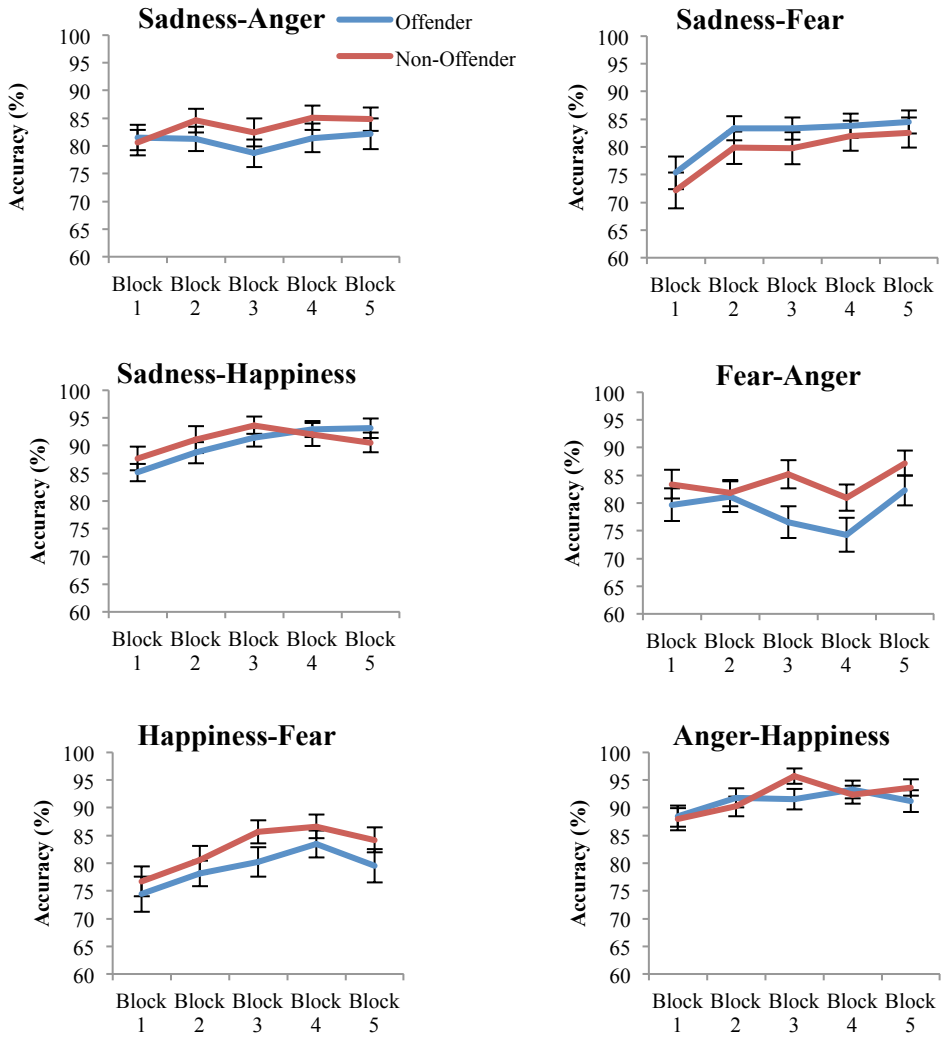

Figure 3. Accuracy scores over blocks of eight trials for all emotion pairs.

Figure 4 shows the average pattern of accuracy averaged across all emotion pairs to show possible effects of training and to compare offenders and non-offenders more clearly. Figure 4 suggests that accuracy increased systematically across blocks, whereas differences between offender and non-offender groups were small. Most notable was the steep increase in accuracy from block one to block two for both groups, and also block two to block three for non-offenders. Accuracy scores for both groups remained stable over the

final three blocks. Overall, these results show that the offenders and non-offenders did not differ significantly in how performance changed across blocks, and so results were aggregated across blocks for subsequent analyses.

Table 2.

Mean accuracy and discriminability scores for all emotion pairs.

Emotion Pair	Mean Accuracy (%)	Discriminability
Sadness-Anger	82.22_a	1.64_a
Sadness-Fear	80.70_a	1.66_a
Sadness-Happiness	90.64_b	2.07_b
Fear-Anger	81.16_a	1.65_a
Happiness-Fear	80.90_a	1.57_a
Anger-Happiness	91.60_b	2.10_b

Subscript indicates significant differences at $p < .01$

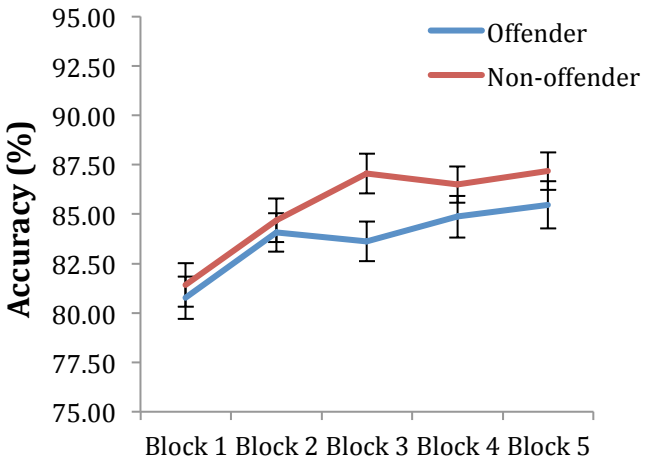

Figure 4. Accuracy scores averaged across all emotion pairs in blocks of eight trials. Standard error bars are shown.

3.3 Signal Detection Measures

Signal detection measures were used in the present study to provide independent measures of bias and discriminability. As mentioned previously, discriminability and bias scores were calculated according to Stanislaw and

Todorov (1999), equations 1 and 2 above. Higher discriminability values indicate that participants were better able to distinguish between the two emotions independently of bias, which is an overall tendency to respond to one emotion or the other. Bias was calculated such that negative values indicated a preference for the first emotion in a pair, whereas positive values indicated a preference for the second emotion in a pair.

3.3.1 Discriminability

Figure 5 shows average discriminability scores for offenders and non-offenders for each model type across the six emotion pairs. A repeated measures ANOVA was conducted with group as a between-subjects factor and emotion pair, age and sex of model as within-subjects factors. A significant main effect of group was found, showing that discriminability was overall higher for nonoffenders (offender M = 1.73, non-offender M = 1.83), $F(1,93) = 5.38$, $p = .023$, $\eta_p^2 = .05$. The effect of emotion pair was also significant (Sadness-Anger M = 1.64, Sadness-Fear M = 1.66, Sadness-Happiness M = 2.07, Fear-Anger M = 1.65, Happiness-Fear M = 1.57, Anger-Happiness M = 2.10), $F(5,465) = 9.99$, $p < .001$, $\eta_p^2 = .25$. There were significant interactions between emotion pair and age, $F(5,465) = 3.43$, $p = .005$, $\eta_p^2 = .04$; emotion pair and sex, $F(5,465) = 4.36$, $p < .001$, $\eta_p^2 = .04$; and emotion pair, age, and sex, $F(5,465) = 3.48$, $p = .004$, $\eta_p^2 = .04$. None of the other interactions were significant.

A general observation was that discriminability was greater when Happiness was one of the emotions than when it was not. To test this observation, post-hoc comparisons were conducted which revealed that participants were significantly better able to discriminate between emotions in the Sadness-Happiness emotion pair than in the Sadness-Anger, $F(1,90) = 57.23$, $p < .001$; Sadness-Fear, $F(1,90) = 52.59$, $p < .001$; and Fear-Anger emotion pairs, $F(1,90) = 39.58$, $p < .001$. Participants were also significantly better able to discriminate between emotions in the Anger-Happiness emotion pair than in the Sadness-Anger, $F(1,90) = 76.95$, $p < .001$; Sadness-Fear, $F(1,90) = 70.31$, $p < .001$; and Fear-Anger emotion pairs, $F(1,90) = 56.08$, $p < .001$. Interestingly, this effect was not observed in the Happiness-Fear emotion pair.

Overall, these results show that non-offenders were somewhat better able to discriminate between emotions than offenders, and that discriminability scores varied depending on the particular emotion pair, such that pairs involving happiness were significantly easier to discriminate, with the exception of Happiness-Fear.

Discriminability by emotion pair and model characteristics

In order to clarify the interactions reported above, we conducted repeated measures ANOVAs with group and age and sex of model as factors, separately for each emotion pair. These results are displayed in Figure 5.

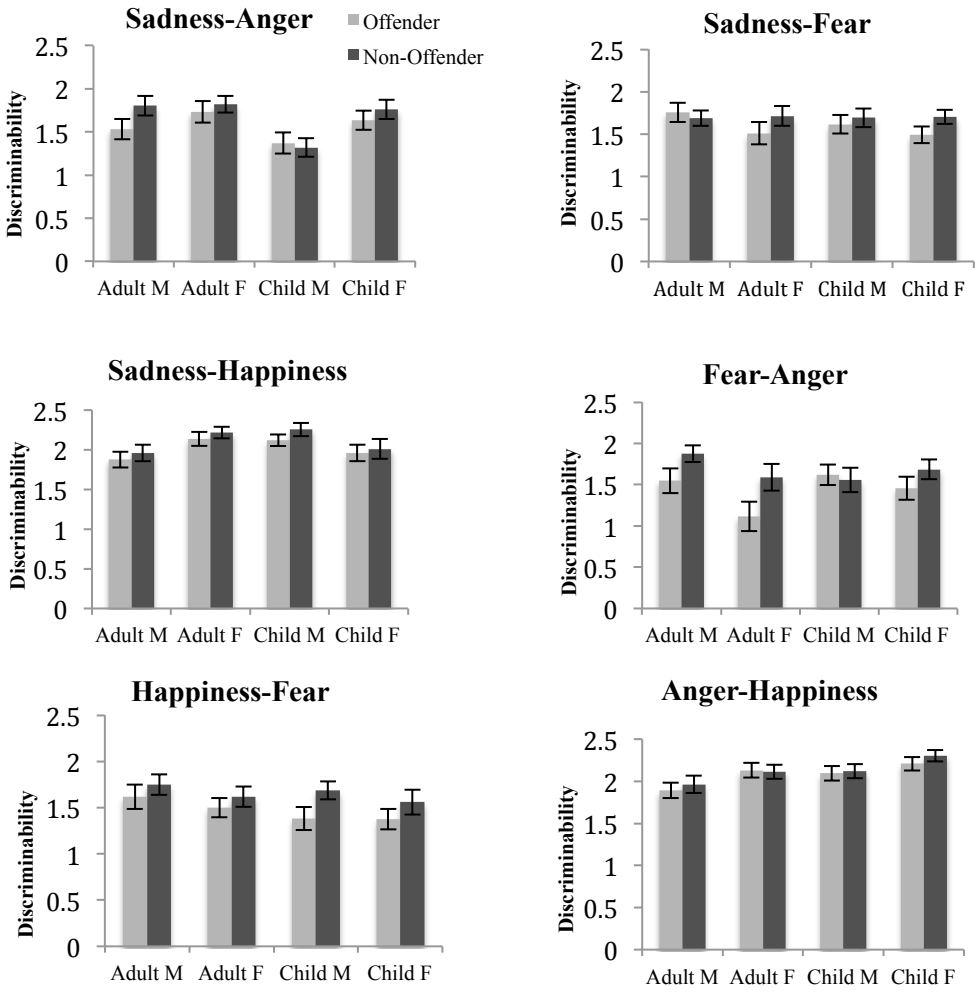

Figure 5. Average discriminability scores across each emotion pair. Standard error bars are shown.

Sadness-Anger

Results for Sadness-Anger are shown in the upper left panel of Figure 5. Both groups were better able to discriminate between the two emotions when judging adult faces than when judging child faces, and when judging female faces than male faces. On average, non-offenders were better able to discriminate between the two emotions, although this difference was not significant. A repeated measures ANOVA revealed two significant main effects: age of model (adult $M = 1.72$, child $M = 1.52$), $F(1,93) = 7.27$, $p = .008$, $\eta_p^2 = .07$; and sex of model (male $M = 1.51$, female $M = 1.74$), $F(1,93) = 8.25$, $p = .005$, $\eta_p^2 = .08$. There were no significant interactions.

Sadness-Fear

Results for Sadness-Fear are shown in the upper right panel of Figure 5. A repeated measures ANOVA revealed no significant main effects or interactions, and there were no differences between the two groups (all *p*s > .10).

Sadness-Happiness

Results for Sadness-Happiness are shown in the centre left panel of Figure 5. A repeated measures ANOVA revealed no significant main effects. However, there was a significant age by sex interaction, $F(1,93) = 19.87$, $p < .001$, $\eta_p^2 = .18$. A test of simple effects revealed significant differences in responses to the different faces: higher discriminability scores for adult female ($M = 2.17$) than adult male ($M = 1.92$), $p = .003$; adult female than child female ($M = 1.98$), $p = .033$; child male ($M = 2.18$) than adult male, $p < .001$; and child male than child female, $p = .035$. Overall, responding was largely similar between the two groups (offenders, $M = 2.02$, non-offenders $M = 2.11$).

Fear-Anger

Results for Fear-Anger are shown in the centre right panel of Figure 5. Non-offenders (*M* = 1.68) were better able to discriminate between the two emotions than offenders (*M* = 1.44), however, the main effect only approached significance, $F(1,93) = 3.54$, $p = .06$. Overall, discriminability scores for this emotion pair were among the lowest, suggesting that participants found these two emotions relatively difficult to discriminate between. A repeated measures ANOVA revealed a significant main effect of sex of model (male *M* = 1.65, female *M* = 1.46), $F(1,93) = 4.35$, $p = .040$, $\eta_p^2 = .04$. There was a also a significant interaction of age and sex of model, $F(1,93) = 4.10$, $p = .046$, $\eta_p^2 = .04$. A test of simple effects revealed significantly higher discriminability scores for adult male than adult female faces, $p = .008$; all other differences were not significant (all *p*s > .10).

Happiness-Fear

Results for Happiness-Fear are shown in the bottom left panel of Figure 5. A repeated measures ANOVA revealed no significant main effects or interactions, and there were no significant differences between the two groups (all *p*s > .05).

Anger-Happiness

Results for Anger-Happiness are shown in the bottom right panel of Figure 5. Participants were significantly more able to discriminate between the two emotions when judging female and child faces than when judging male and adult faces. A repeated measures ANOVA revealed two significant main effects: age of model (adult *M* = 2.03, child *M* = 2.18), $F(1,93) = 9.86$, $p = .002$, $\eta_p^2 = .10$; and sex of model (male *M* = 2.02, female *M* = 2.19), $F(1,93) = 7.64$, $p = .007$, $\eta_p^2 = .08$. There were no significant interactions or group differences.

Summary

Overall, when responding was averaged across all emotion pairs, non-offenders showed significantly higher levels of discriminability than offenders. In the individual emotion pairs however, both groups showed reasonably high levels of discriminability, although they performed better with some emotion pairs than others. In particular, both groups performed worse in emotion pairs containing two negative emotions (although Happiness-Fear was an exception to this) than pairs containing one positive and one negative emotion. Effects of model characteristics appeared to be associated with specific emotion pairs.

3.3.2 Bias by emotion pair and model characteristics

Figure 6 shows average bias scores for offenders and non-offenders across each of the six emotion pairs. Positive bias values indicate a greater tendency to respond to the second emotion in the pair, while negative values indicate a greater tendency to respond to the first emotion in the pair. Because both relative (i.e., whether bias depends on group and model characteristics) and absolute (i.e., whether there is a significant bias towards a particular emotion) levels of bias are of interest, we first report repeated measures ANOVAs for each emotion pair and then confidence intervals (Table 2) to test whether bias values deviate significantly from zero. Because bias values are specific to emotion pairs and their sign is arbitrary, we do not report an omnibus ANOVA across emotion pairs but rather separate ANOVAs to examine relative bias for each pair.

Sadness-Anger

Results for Sadness-Anger are shown in the upper left panel of Figure 6. A repeated measures ANOVA revealed no significant main effects or interactions, and there were no differences between the two groups (all *p*s > .10).

Sadness-Fear

Results for Sadness-Fear are shown in the upper right panel of Figure 6. On average, offenders showed a stronger bias towards sadness than non-offenders, although the difference was not significant (p = .35). A repeated measures ANOVA revealed two main effects: age of model (adult M = -.01, child M = .24), $F(1,93) = 26.86$, $p < .001$, $\eta_p^2 = .22$; and sex of model (male M = .18, female M = .05), $F(1,93) = 7.17$, $p = .009$, $\eta_p^2 = .07$. The age by sex interaction was also significant, $F(1,93) = 30.56$, $p < .001$, $\eta_p^2 = .025$. A test of simple effects revealed significant differences in responses to the different faces: participants showed a bias towards sadness for adult females but fear for all other faces (ps < .001); and a stronger bias towards fear for child females than child males (p < .001).

Sadness-Happiness

Results for Sadness-Happiness are shown in the centre left panel of Figure 6. Participants showed a stronger bias towards happiness when judging adult faces than child faces, and male faces than female faces. Noticeable is the change in bias in responding from sadness for child female faces, to happiness for all other faces. A repeated measures ANOVA revealed two main effects: age of model (male M = .11, female M = .03), $F(1,93) = 5.30$, $p = .024$, $\eta_p^2 = .05$; and sex of model (male M = .15, female M = -.01), $F(1,93) = 21.26$, $p < .001$, $\eta_p^2 = .19$. There were no significant interactions or differences between the two groups.

Fear-Anger

Results for Fear-Anger are shown in the centre right panel of Figure 6. A repeated measures ANOVA revealed two main effects: age of model (adult M = .08, child M = -.02), $F(1,93) = 7.86$, $p = .006$, $\eta_p^2 = .08$; and sex of model (male M = -.12, female M = .18), $F(1,93) = 47.99$, $p < .001$, $\eta_p^2 = .34$. There were also significant interactions: sex of model and group, $F(1,93) = 8.30$, $p = .005$, η_p^2 =

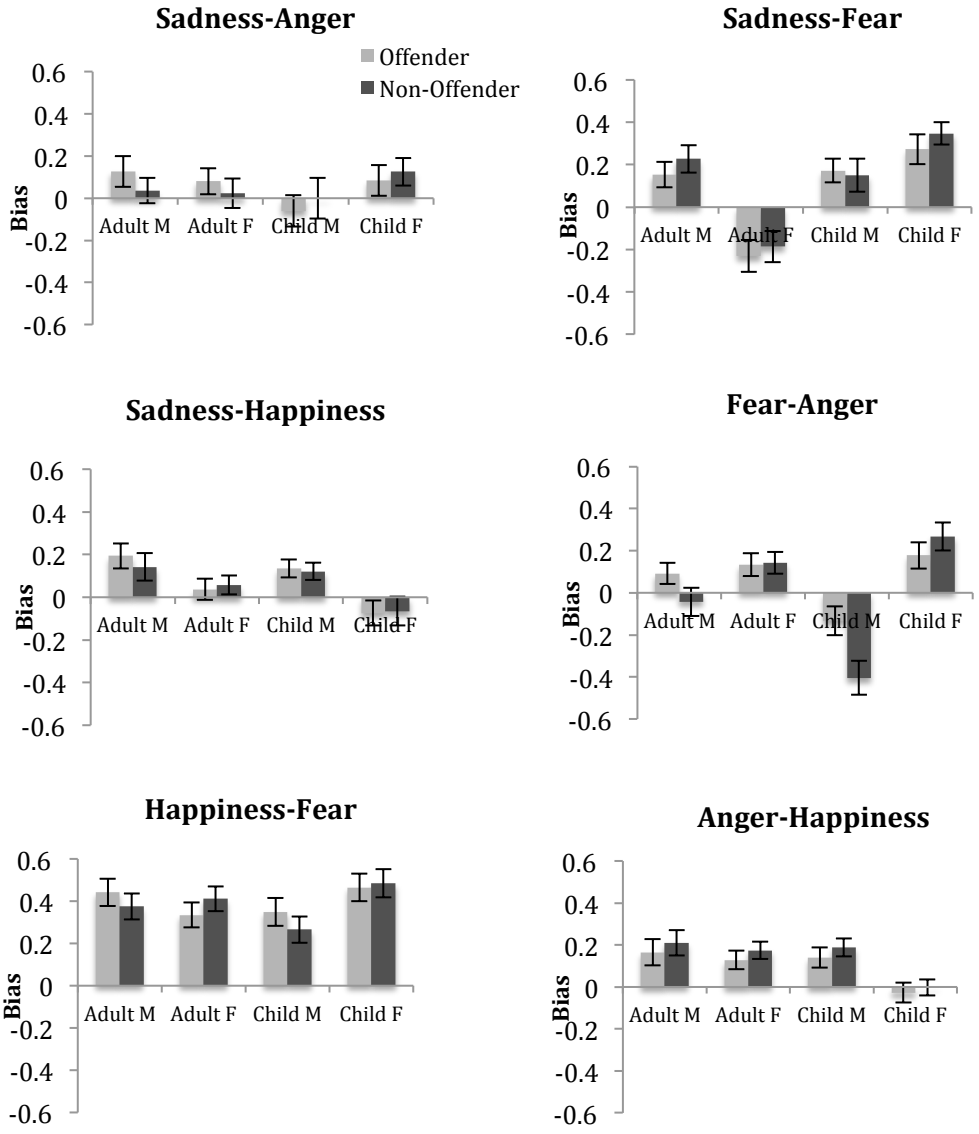

Figure 6. Average bias scores across each emotion pair. Standard error bars are shown.

.08; and age and sex of model, $F(1,93) = 16.20$, $p < .001$, $\eta_p^2 = .15$. The three-way interaction of sex, age, and group was not significant ($p = .25$).

Overall, non-offenders showed more bias in their responding than offenders, although this-difference was not significant, $F = 2.34$, $p = .13$. A test of simple effects revealed that non-offenders ($M = -.22$) showed significantly more bias towards labeling the emotion as fear when judging male faces than offenders ($M = -.02$, $p = .004$). In addition, non-offenders showed a bias towards fear for male faces ($M = -.22$) and anger for female faces ($M = .20$, $p < .001$);

offenders showed a similar pattern of responding, although they showed less bias towards both emotions (M = -.02 and .16 respectively, p = .005).

Participants showed a stronger bias towards anger when judging adult female faces than adult male faces (p = .022). However, most noticeable is the large change in bias with child male (M = -.27) and child female (M = .22, p < .001) models. Both offenders and non-offenders showed the strongest bias towards responding anger when judging child females, and the strongest bias towards responding fear when judging child males.

Happiness-Fear

Results for Happiness-Fear are shown in the bottom left panel of Figure 6. A repeated measures ANOVA revealed no significant main effects. However, there was a significant interaction between age and sex of model, $F(1,93) = 5.92$, $p = .017$, $\eta_p^2 = .06$. Overall, both groups responded similarly, showing a stronger bias towards labeling the emotion as fear when judging child female faces than when judging child male faces (p = .004). Offenders did show more bias when judging male faces than non-offenders, and the reverse was true for female faces, although this difference was not significant (p = .08).

Anger-Happiness

Results for Anger-Happiness are shown in the bottom right panel of Figure 6. A repeated measures ANOVA revealed two significant main effects: age of model (adult M = .17, child M = .07), $F(1,93) = 9.31$, p = .003, $\eta_p^2 = .10$; and sex of model (male M = .18, female M = .07), $F(1,93) = 10.87$, p = .001, $\eta_p^2 = .10$. There was also a significant interaction between age and sex of model, $F(1,93) = 5.52$, p = .021, $\eta_p^2 = .06$. A test of simple effects revealed participants showed a stronger bias towards happiness when judging adult male, adult female and child male faces than when judging child female faces (ps < .001).

Table 3 reports mean bias values and 95% confidence intervals for each emotion pair. Table 3 shows that bias values were higher for some emotion pairs

than others, and often participants would show bias towards one emotion for a particular model, and towards the other emotion for another model. Overall, confidence intervals for average bias values excluded zero, indicating significant levels of absolute bias in all emotion pairs, with the exception of Fear-Anger. The strongest levels of bias were obtained with Happiness-Fear, where participants showed a tendency to identify fear regardless of model characteristics.

Table 3.

Means and 95% confidence intervals for average bias values (positive values indicate a bias for the second emotion in the pair).

Emotion Pair: Model Type	Mean bias values (95% CI)
Sadness-Anger:	
Average	**0.052 (0.003 – 0.101)**
Adult Male	0.082 (-0.012 – 0.177)
Adult Female	0.052 (-0.039 – 0.143)
Child Male	-0.032 (-0.150 – 0.087)
Child Female	**0.104 (0.007 – 0.201)**
Sadness-Fear:	
Average	**0.113 (0.068 – 0.158)**
Adult Male	**0.189 (0.102 – 0.276)**
Adult Female	**-0.209 (-0.312 – -0.105)**
Child Male	**0.162 (0.068 – 0.257)**
Child Female	**0.309 (0.222 – 0.397)**
Sadness-Happiness:	
Average	**0.069 (0.019 – 0.118)**
Adult Male	**0.169 (0.083 – 0.255)**
Adult Female	0.047 (-0.018 – 0.112)
Child Male	**0.128 (0.071 – 0.186)**
Child Female	-0.070 (-0.158 – 0.018)

Fear-Anger:	
Average	0.030 (-0.020 – 0.080)
Adult Male	0.025 (-.058 – 0.108)
Adult Female	**0.138 (0.064 – 0.211)**
Child Male	**-0.265 (-0.373 – -0.157)**
Child Female	**0.221 (0.130 – 0.312)**
Happiness-Fear:	
Average	**0.391(0.333 – 0.449)**
Adult Male	**0.409 (0.321 – 0.497)**
Adult Female	**0.372 (0.290 – 0.454)**
Child Male	**0.309 (0.218 – 0.400)**
Child Female	**0.475 (0.382 – 0.567)**
Anger-Happiness:	
Average	**0.121 (0.078 – 0.164)**
Adult Male	**0.187 (0.100 – 0.274)**
Adult Female	**0.151 (0.090 – 0.211)**
Child Male	**0.164 (0.099 – 0.229)**
Child Female	-0.015 (-0.076 – 0.046)

Intervals in boldface do not include 0 and are therefore significantly different from 0 at p < .05.

Summary

Overall, Offenders and non-offenders showed similar levels of bias when responding to the models. However, a significant difference emerged between the two groups in the Fear-Anger emotion pair, where non-offenders showed a stronger bias towards responding fear when judging male faces than offenders. When responses were averaged across the groups, the direction of bias was often dependent on the model type (male or female, adult or child), although this varied depending on the emotion pair.

3.4 Analysis of covariance

Because offenders and non-offenders differed significantly in terms of age, education and SES (see Table 1), it is important to determine if differences on these demographic variables might have contributed to the significant group differences in the responding that was found in the Fear-Anger emotion pair. To evaluate this possibility we conducted an ANCOVA.

First, we wished to determine whether the demographic variables obtained were correlated with bias and discriminability. Table 4 displays correlations of age, education and SES with discriminability scores for each emotion pair. However, the NZSEI-06 does not have a category for students and so their SES score is based on their highest level of education, making comparisons difficult to interpret. When averaged across all emotion pairs, discriminability was significantly negatively correlated with age (r = -.34, p < .001) and positively correlated with education (r = .20, p = .045). Bias values were not averaged across emotion pairs. When examining individual emotion pairs, age was the only demographic variable significantly correlated with discriminability, and only in the pairs of Sadness-Happiness (r = -.22, p = .036) and Happiness-Fear (r = -.25, p = .016). Bias scores were not correlated with any of the demographic variables; therefore these correlations are not presented in the table. Due to the significant correlations of both age and education with discriminability, an ANCOVA was performed on the emotion pair where a significant group difference was found (Fear-Anger), with group as a between-groups variable and age, education, and SES as covariates.

Results from the ANCOVA revealed that none of the demographic variables were significant predictors of bias scores in the Fear-Anger emotion pair: Age $F(1,90) = 0.49$, p = .49; education $F(1,90) = 0.12$, p = .73; SES $F(1,90) = 2.02$, p = .16. There was no main effect of group (p = .14), and no interactions involving the demographic variables, model characteristics, or group. However, the interaction of group and sex of model remained significant $F(1,90) = 4.44$, p = .038. This result suggests that differences in responding between the two groups in this emotion pair were not due to the factors of age, education, or

socioeconomic status. However, age was a significant predictor of overall discriminability scores, $F(1,90) = 5.31$, $p = .023$, and with age or level of education as a covariate, the main effect of group was no longer significant, $F(1,90) = 0.01$, $p = .94$ and $F(1,92) = 1.47$, $p = .23$, respectively.

Ethnicity was also investigated as a covariate in a separate analysis. However it was not a significant predictor of either bias or discriminability scores in any of the emotion pairs (all *p*s > .10), suggesting that both Māori and non-Māori responded similarly to the task.

Table 4.

Correlations of age, education and SES, with discriminability and bias.

	Age	Education	SES
Discriminability:			
Overall	-.34**	.20*	.08
Sadness-Anger	-.15	.10	-.04
Sadness-Fear	-.03	.08	.11
Sadness-Happiness	-.22*	.12	.05
Fear-Anger	-.16	.15	.12
Happiness-Fear	-.25*	.10	-.00
Anger-Happiness	-.17	.04	-.03
Age	-	-.48**	-.22*
Education	-	-	.73**
SES	-	-	-

* *Significant at p < .05*

** *Significant at p < .01*

3.5 Psychometrics

Previous studies have suggested that both psychopathy and intelligence may affect emotion recognition abilities. We were able to obtain psychopathy scores for non-offenders and IQ scores for offenders and correlated these with both discriminability and bias scores, as well as the demographic variables, to examine whether performance on the emotion recognition task was related to

psychopathy (non-offenders) and IQ (offenders). These analyses are limited because we did not have either psychopathy or IQ scores for both groups.

3.5.1 Levenson Self-Report Psychopathy Scale (LSRP)

As mentioned previously, the LSRP is a self-report measure of psychopathy with two subscales. The LSRP was administered to non-offenders and their scores on each subscale, as well as an average score, were recorded. LSRP-Primary scores were correlated only with LSRP-Secondary (r = .30, p = .049) and LSRP-Average scores (r = .78, p < .001). However, LSRP-Secondary scores were significantly correlated with age (r = -.42, p = .005), SES (r = -.34, p = .027), discriminability in the Sadness-Anger emotion pair (r = -.32, p = .039), and average accuracy (r =-.32, p =.035). All other correlations of LSRP-S with discriminability and bias were not significant.

3.5.2 Wechsler Abbreviated Scale of Intelligence *(WASI)*

WASI scores were obtained for most offenders as Oliver et al. (2009) found that IQ had a significant effect on emotion recognition accuracy. However, we found IQ to only be significantly correlated with education level (r = .49, p < .001) and bias in the Sadness-Happiness emotion pair (r = .39, p = .008). This suggests that offenders with high IQs would be more likely to show a bias for happiness, whereas offenders with low IQ would be more likely to show a bias for sadness, although the relationship is only moderate. Average accuracy and discriminability were not correlated with IQ (r = .08 and .08 respectively).

Discussion

4.1 Summary

The present study set out to determine if child sexual offenders displayed deficits in recognising facial expressions of emotion in both adults and children, relative to a control sample of non-offenders. Participants viewed images of

models (male and female, adults and children), which were morphed between two different emotions in varying amounts (e.g. 20% happiness - 80% sadness). The results were not entirely as expected. Whereas non-offenders were significantly more able to discriminate between emotions overall, the difference was relatively small and not significant for any of the individual emotion pairs. However, when age, education, and SES were used as covariates in an ANCOVA, the difference in discriminability was no longer significant. In addition, offenders did not show any specific deficits in their ability to discriminate between emotions when judging faces of children. However, a significant interaction between group and sex of model did emerge for bias scores in the Fear-Anger emotion pair. Non-offenders showed a significant bias towards labeling the emotion as fear rather than anger when viewing male faces, whereas offenders did not. In addition, both groups showed a bias towards fear for male faces, and anger for female faces.

4.2 Bias and Discriminability

4.2.1 Bias

Generally, both offenders and non-offenders showed similar patterns of bias in each emotion pair. However, in the Fear-Anger pair, non-offenders showed a significantly stronger bias towards fear when judging male faces than offenders, and this difference was more pronounced for child male faces than adult male faces (p = .099). This result could suggest that non-offenders have an inhibition to identify anger due to its potentially violent consequences, although it is unlikely that adults would be so fearful of angry children. However, the fact that offenders showed less of a bias towards fear is not surprising as several studies have found that sexual offenders are more accurate at recognising angry than fearful expressions (e.g. Gery et al., 2009; Hudson et al., 1993; Robinson et al., 2012). This finding supports our results for this emotion pair, and suggests that offenders may have had more difficulty recognising fear than anger, and thus shown less of a bias than non-offenders towards responding 'fear'.

Overall, bias scores favoured both positive (happiness) and negative (fear, anger and sadness) emotions, although participants generally showed a bias towards responding 'happiness' when it was one of the two emotions. However, in Happiness-Fear emotion pair, participants showed a consistently strong bias towards responding 'fear' when judging all faces. Several participants made comments about the morphs in this pair, saying that quite often the models looked uneasy or slightly worried, even at low percentages of fear, and this may have contributed to the strong tendency to respond 'fear' in this emotion pair. Interestingly, participants often showed a bias towards one emotion for three out of the four model types, and towards the other for the remaining model type. This pattern of responding was not uncommon, and occurred in most emotion pairs.

Contrary to our prediction, there was no evidence that offenders showed a stronger bias toward positive emotions than non-offenders. Both groups showed similar levels of bias towards responding happiness in two out the three emotion pairs containing the emotion.

4.2.2 Discriminability

When responses were averaged across emotion pairs, non-offenders were significantly better at discriminating between emotions than non-offenders. This finding supports our hypothesis that offenders would show more difficulty discriminating between emotions than a comparable group of non-offenders and is consistent with previous research (Gery et al., 2009; Hudson et al., 1993; Oliver et al., 2009; Robinson et al., 2012).

There were no significant group differences in individual emotion pairs, however the difference in discriminability in the Fear-Anger emotion pair was the largest (p = .06); non-offenders (M = 1.68) were better able to discriminate between the two emotions than offenders (M = 1.44). Interestingly, both groups performed worse in emotion pairs containing fear, and this was particularly evident for the offenders, whose average discriminability for the three emotion pairs containing fear was 1.57 and for the remaining three pairs 1.90 (non-offenders were 1.69 and 1.97 respectively). This finding in particular may have

clinical implications as a study by Marsh, Kozak, and Ambady (2007) suggests a link between accurate recognition of fear and prosocial behaviour, and multiple studies have shown a link between inaccurate recognition of fear and antisocial behaviour (Marsh & Blair, 2008).

On average, non-offenders (M = 1.81) were better able to discriminate between emotions in child faces than offenders (M = 1.72), particularly female children, although this difference was not significant (p = .084). When analysed by emotion pair, offenders had higher discriminability when judging male children than non-offenders in the Fear-Anger and Sadness-Anger emotion pairs, although these differences were relatively small. In all other emotion pairs, non-offenders had higher discriminability for child faces. In particular, there were large differences between the groups in the Happiness-Fear (non-offenders M = 1.62, offenders M = 1.38, p = .062) and Sadness-Fear (non-offenders M = 1.70, offenders M = 1.55, p = .190) emotion pairs. This finding largely supports our hypothesis that offenders would show more difficulty in discriminating between emotions in children, relative to non-offenders. However, neither group performed significantly better with adult faces than child faces.

Overall, participants were generally able to discriminate well between the two emotions in each pair. However, model age and sex had a significant effect on participants' ability to discriminate in four of the six emotion pairs. However, there appeared to be no consistent pattern to these differences and overall there were no significant differences in the average discriminability of adult and child, or male and female faces.

4.2.3 Accuracy

When responses were averaged across all emotion pairs, a systematic increase was seen over the first three blocks of trials from both groups. This is likely due to participants becoming familiar with the task over this time. Accuracy scores peaked in the final block of trials for both groups, with non-offenders at 87.18% and offenders at 85.47%. A significant main effect of emotion pair was found, which showed that accuracy was dependent on which

two emotions were being discriminated between. In light of this, accuracy scores were also analysed separately for each of the six emotion pairs. Overall, accuracy scores were largely similar for both offenders and non-offenders, although both groups performed better in some emotion pairs than others. In particular, offenders performed particularly poorly in the Fear-Anger emotion pair, although the difference between the two groups was not significant (p = .054). Accuracy was significantly higher for both groups in the Sadness-Happiness (90.64%) and Anger-Happiness (91.60%) pairs than the other four emotion pairs. Suggesting that both groups found it easier to judge the faces when they were selecting between emotions of opposite valence, as would be expected. In contrast, accuracy was much lower in the Happiness-Fear (80.90%) pair.

4.2.4 Covariates and psychometrics

Due to the significant differences between offenders and non-offenders on the demographic measures of age, education, and socioeconomic status (SES), we performed an ANCOVA with these as covariates for bias scores in the Fear-Anger emotion pair and overall discriminability scores. None of the demographic measures were significant covariates for bias scores, suggesting our initial finding was robust and not due to the significant demographic differences between the two groups. However, for overall discriminability scores, age was a significant covariate, and this caused the difference in discriminability to no longer be significant. This result is in line with previous research, as our sample of offenders performed significantly poorer on the task and were significantly older than the non-offenders (M = 46.37 and 25.67 years respectively) supporting the theory that emotion recognition ability decreases as we age, particularly once we pass 40 years of age (Calder et al., 2003; Kessels et al., 2014; Ruffman et al., 2008).. In addition, the group difference was also not significant when level of education was used as a covariate, which is in line with Kessels et al. (2014) who found that years of education was significantly positively correlated with recognition of fear, happiness, sadness, and total score on their emotion recognition task. Additionally, Oliver et al. (2009) found that recognition accuracy of fear and surprise was significantly affected by IQ.

Finally, ethnicity was also used as a separate covariate but was not a significant predictor of bias or discriminability in any of the emotion pairs.

Previous studies have suggested that IQ and psychopathy can have an effect on emotion recognition (Hastings, Tangney, & Stuewig, 2008; Oliver et al., 2009). Adams (2012) provided support for this view. Specifically, she found a large negative correlation between psychopathy and fear processing in male youth, suggesting that psychopathic male individuals have a deficit that prevents them from recognizing fear or distress in others, which reduces the likelihood of inhibiting aggressive behaviour. Montagne, van Honk, et al. (2005) found similar results in a sample of male and female university students who scored highly on psychopathic personality characteristics. Interestingly, this deficit was not apparent when making judgments of faces in side profile. However, Montagne, van Honk, et al. (2005) did not test for sex differences and this may have affected their results as Montagne, Kessels, Frigerio, de Haan, and Perrett (2005) found that male university students were both less accurate and less sensitive in labeling facial expressions than female university students, although neither study used a broad range of participants, and it is possible that these effects may dissipate with age (Rahman, Wilson, & Abrahams, 2004). Hastings et al. (2008) also found a relationship between psychopathy and a deficit in recognition of facial expressions, although this was most notable for happy and sad expressions and not fearful ones.

Interestingly, we did not find enough evidence to suggest that either IQ or psychopathy should be used as covariates in our analyses. Both measures were only each correlated with one of the signal detection measures in one emotion pair. In any case, we were only able to obtain IQ scores for offenders and psychopathy scores for non-offenders, so were unable to use these measures as covariates in the between-group analyses.

4.3 Validity of using posed expressions

As mentioned previously, participant responses varied depending on not only the emotions displayed, but also the sex and age of the model expressing

the emotion. These differences were not systematic which makes interpretation difficult. However, several explanations will be examined below.

4.3.1 Sex differences in the way emotions are expressed

Some studies have found differences in the way males and females display emotion via facial expressions. For example, Friedman, Riggio, and Segall (1980) had judges rate videos of participants reading neutral sentences while portraying one of six basic emotions. They found that females were better at enacting anger, happiness, surprise, and disgust than males, although this difference was only significant for anger expressions. Wagner, MacDonald, and Manstead (1986) also found sex differences in the displaying of facial expressions. In their study, participants (senders) were covertly videotaped while they viewed emotionally loaded photographic slides. Following each slide, participants were asked to indicate which of the seven basic emotions best described their reaction, as well as the pleasantness and strength of the reaction. The videos were then rated in the same way by a separate group of people (receivers). Wagner et al. (1986) found several interesting results: First, male receivers' judgments of anger significantly exceeded chance levels, whereas female receivers' judgments did not. Second, male senders were correctly judged significantly *above* chance levels when they expressed sadness, disgust, anger, and happiness, but significantly *below* chance levels when they expressed surprise. Female senders were correctly judged significantly above chance levels when they expressed disgust, anger, and happiness. Finally, male and female senders were correctly judged at significantly different levels when expressing sadness (21.84% and 10.43% respectively) and surprise (4.40% and 19.18% respectively). These results suggest that our sample of men may naturally have been more sensitive to expressions of anger, as well as being influenced in their responding by the sex of the model they were judging and the emotion being expressed. Indeed, we did find large differences in the discriminability of male and female faces in the Sadness-Anger and Anger-Happiness emotion pairs. Participants were significantly more able to discriminate between sadness and anger, and anger and happiness when judging female faces (M = 1.74 and 2.18

respectively) than when judging male faces (*M* = 1.50 and 2.02, *p*s = .008 and .009 respectively). However, there were no such differences in the Sadness-Fear or Sadness-Happiness emotion pairs.

Additionally, Wallbott (1988) had judges rate short clips of actors expressing emotion in movies. He found that female actors were able to communicate sadness and fear significantly better than male actors, but were significantly worse at communicating anger. These results reflect the gender stereotypes that males should not cry and that females should not express feelings of anger openly (Wallbott, 1988). We did not find any evidence that participants found it more difficult to recognise anger when expressed by female models. However, we did find that both offenders and non-offenders showed a bias towards responding 'anger' when judging female faces but not male faces in the Fear-Anger emotion pair, which may indicate that our sample of men were more likely to judge anger in women than in other men.

4.3.2 Differences between genuine and posed expressions

In addition to the differences in expression of emotion due to sex, sincerity also affects how accurately an emotion is expressed. Gosselin, Kirouac, and Doré (1995) had actors perform scenarios, which were written to elicit one of six emotions. Each actor performed each scenario twice, once while trying to feel the emotion of the character they were playing (EFE condition), and once without feeling the emotion (EUE condition). These sessions were rated by the actors themselves three times (immediately after each portrayal, after each session, and two months later), and once by independent judges. Only successful portrayals were used in the study and these were scored using the Facial Action Coding System (FACS; Ekman & Friesen, 1978). Gosselin, Kirouac, and Doré (1995) found that portrayals of happiness, anger, and sadness in the EFE condition were significantly closer to genuine expressions of emotion than portrayals of these emotions in the EUE condition. This result is important for the present study as the majority of images we used were of actors expressing these three emotions (as well as fear). Indeed, in their validation of the Radboud database, Langner et al. (2010) found that raters had an overall agreement rate

of 82%. Although the authors claim that this is a high rate of agreement compared to other such databases, it still leaves room for differences in responding purely based on how well the models have expressed the emotions, which may impact the results of research utilising this database, even if to a limited extent.

In addition to sincerity, control over our own facial muscles is another important factor in the success of posed expressions. Mehu, Mortillaro, Bänziger, and Scherer (2012) identified two subsets of facial action units (AUs; the individual muscle movements that make up facial expressions): reliable AUs and versatile AUs. While versatile AUs are easily manipulated, reliable AUs are not readily subject to volitional control (Ekman, 2001; 2003a). FACS experts rate reliable AUs as being significantly less controllable than versatile AUs (Mehu et al., 2012), and only a small percentage of people inexperienced with FACS are able to voluntarily perform the reliable AUs (Gosselin, Perron, & Beaupré, 2010). Mehu et al. (2012) found that judges rated expressions as significantly more intense, authentic and accurate when reliable AUs were used in the expression. Again, these findings are important as genuine expressions of fear and happiness contain both reliable and versatile AUs, and genuine expressions of sadness contain only reliable AUs (Ekman, 2003). Future databases would benefit from focusing on training models to pose reliable AUs as well as taking steps to ensure models expressions appear as genuine as possible, therefore improving research that require the use of such databases.

4.4 Processing of angry faces and parallels to studies with abused children

Offenders in particular struggled to discriminate between anger and fear, as well as anger and sadness. It is interesting that participants had trouble with the Anger-Fear emotion pair considering the difference in appearance of the face expressing these two emotions (e.g. eyebrows raised vs. eyebrows lowered; eyes wide vs. eyes narrowed), such low accuracy rates would suggest that sexual offenders have difficulty recognising both anger and fear, which would lead to difficulty in discriminating between the two. Some studies have shown that sexual offenders do have difficulty recognising these emotions (e.g. Gery et al.,

2009), and other studies suggest that children who have been abused or have behavioural problems also have difficulty recognising anger and fear expressions (Blair & Coles, 2000; Jonson-Reid & Way, 2001). It is important to examine these studies with abused children as it is often the case that adult sexual offenders were abused themselves during their childhood (Burton, 2000; Graham, Kimonis, Wasserman, & Kline, 2012).

4.4.1 Abuse histories of sexual offenders

While a history of childhood abuse by no means cements a child into a life of sexually abusing others, the literature on sexual offenders has predominantly shown that children who have been abused are at an increased risk of subsequent sexual offending (Starzyk & Marshall, 2003). In addition, childhood sexual abuse can also lead to these children not developing necessary coping strategies, as well as putting them at increased risk of developing general behaviour problems, poor self-esteem, fear, and depression (Kendall-Tackett, Williams, & Finkelhor, 1993). The rates of childhood abuse in adult sexual offenders vary from study to study, with numbers as high as 75%, although Barbaree, Marshall, and McCormick (1998) found an average of 28% in a meta-analysis across several studies. J. S. Levenson, Willis, and Prescott (2014) found that sexual offenders were twice as likely to have been sexually abused themselves than non-offenders, based on responses to the Adverse Childhood Experience (ACE) questionnaire. Sexual offenders reported significantly more adverse experiences than non-offenders, with odds ratios ranging from 1.58 to 13.88. Only 16% of the sexual offenders reported no adverse childhood experiences, whereas more than a third of non-offenders reported this. In addition, nearly half of sexual offenders endorsed four or more items on the ACE, suggesting that these offenders were raised in a dysfunctional environment with negative role models, that was not conducive to positive development. Higher ACE scores are also associated with more serious and frequent sexual abuse. Other studies have also found higher rates of childhood sexual abuse in child sex offenders relative to the general population (Jespersen, Lalumière, & Seto, 2009; Reavis, Looman, Franco, & Rojas, 2013). Additionally, Reavis et al.

(2013) suggest that treatment interventions for offenders that do not attempt to alleviate the neurobiologic wounds caused by childhood abuse are "…destined to fail." (Reavis et al., 2013, p. 47).

4.4.2 Studies with children

Having identified that a significant proportion of sexual offenders in the general population were themselves abused as children, it is important to examine if this may have influenced how the offenders responded to the stimuli. Using a procedure similar to the present study, Pollak and Kistler (2002) created morphed expressions in 10% increments (using happiness, sadness, fear, and anger) that lay on a continuum from one emotion to a second emotion. However, they only created four of the six possible continua (they did not use Sadness-Fear or Happiness-Anger). Children who had been abused overidentified anger relative to fear and sadness, whereas control children underidentified anger. This difference was most pronounced for the Fear-Anger continuum, where abused children showed a strong bias towards labeling an emotion as anger and control children showed a strong bias towards labeling an emotion as fear. These results are similar to the present study, as we found that non-offenders showed a significantly stronger bias towards labeling an emotion as fear when judging male faces than offenders in the Fear-Anger emotion pair. Pollak and Sinha (2002) found a similar result, albeit with a slightly different procedure. They used a random image structure evolution (RISE) procedure to create a continuum of images that ranged from a scrambled face to a clear face expressing an emotion. Again, abused children were significantly more sensitive to anger expressions, with higher accuracy rates than control children across the entire continua (i.e. abused children needed less information to identify an angry expression than control children), although this was not due to a response bias for anger unlike the findings of Pollak and Kistler (2002). The opposite result was found for sad expressions, with control children showing higher accuracy than abused children. Pollak, Messner, Kistler, and Cohn (2009) also found that abused children were more sensitive to angry expressions than controls, with the abused children in their study accurately recognizing angry

expressions even when few physiological clues were available to them. Their reaction times were also related to the degree of abuse they had suffered. One possible explanation for these results is that abused children display increases in the amplitude of the event-related potential (ERP) component P3b relative to control children and adults when actively searching for angry faces, but not other emotional expressions (Pollak & Tolley-Schell, 2003). Pollak and Tolley-Schell (2003) took this one step further by testing abused children's ability to disengage attention from angry facial cues. To do this they adapted a visual selective attention paradigm to include an affective component. Abused children responded faster to valid angry trials than they did to valid happy trials, with no loss of accuracy. In fact, abused children responded faster to valid angry trials than control children responded to either valid angry or happy trials.

These results are very similar to the pattern of responding shown by offenders and non-offenders in this study. Without having information on the histories of the offenders who participated, it is difficult to speculate on the reasons behind their responding. However, it is possible that at least some of the offenders had been abused as children, and as discussed above this would have a negative effect on their ability to discriminate between anger and other negative emotions (offenders' accuracy was lowest for both the Fear-Anger and Sadness-Anger emotion pairs, which is consistent with the results of the previously mentioned studies with abused children). In addition, offenders are likely to encounter anger in the prison environment much more regularly than non-offenders would in the general population. On the other hand, it may be that non-offenders are more inclined to avoid confrontation and the negative consequences that can come with anger, such as violence and the body's fight or flight response. In support of this, Seidel, Habel, Kirschner, Gur, and Derntl (2010) found that anger expressions tended to elicit avoidance behaviours from a sample of university students. In addition, they also found that participants responded faster to male faces when responses were made with a pushing motion (avoidance) than when a pulling motion (approach) was used, and the opposite was found for female faces. As would be expected, male angry faces were responded to significantly faster than female angry faces. Interestingly, Krieglmeyer and Deutsch (2013) found that angry faces can facilitate both

approach and avoidance, depending on the intentions of the goals of the individual making the behaviours.

4.5 Limitations

There were several limitations in this study. Firstly, Offenders and non-offenders differed significantly on every demographic measure we obtained (age, education, socioeconomic status). This was anticipated as we were unable a matched-control design was impractical for the present study. However, given that offenders were significantly older than non-offenders, it is not surprising that they had a lower level of education overall. Significant education reforms were undertaken in New Zealand in the late 1980's, and these were followed by a decline in 'blue collar' jobs and a rise in 'white collar' jobs (Boston, Martin, Pallot, & Walsh, 1996). Attitudes towards tertiary education became more positive and student numbers more than doubled over a 15-year period, and have continued to rise steadily since (McLaughlin, 2003).

The experimental design, which underwent several revisions, could also be another source of the lack of significant differences. In particular, many participants mentioned that they did not see the emotion that the face was meant to be showing, even in practice trials, which did not use morphed expressions. While the Radboud Faces Database (RaFD; Langner et al., 2010), which we used to obtain the images has been validated in several studies, there was large variability in the way emotions were expressed on the faces of the models, as well as the intensity. Morphing the images was also difficult with certain images, as in some cases where the models had their faces tilted forward or backward for one emotion, and then were sitting with their heads level for another, and this undoubtedly reduced the quality of the morphs. In addition, the morphing software (Fantamorph) produced inconsistent results. Morphs generally resembled the second image more than the first at the 50% point on the continuum, and this was most evident when pairing happiness with the other emotions. Several participants mentioned that they saw very little happiness in any of the faces in the Happiness-Fear emotion pair (interestingly, this emotion pair had one of the highest hit rates and lowest false alarm rates).

Finally, we were only able to obtain IQ scores for offenders, and psychopathy scores for non-offenders. This may have affected the results we obtained when analysing the relationship between these measures and responding, because statistical power was limited and we were unable to use these as covariates in the betwee-groups analyses.

These limitations should be addressed in future research, and it may also be wise to adopt a more dynamic morphing procedure, so that faces display a natural change from neutral to an emotion and back to neutral or to another emotion, which is more realistic and would mimic the changes seen in real world settings.

4.6 Implications and future research

Unfortunately, relatively little research has been conducted in this area, and even less using faces of children. This study should encourage future research into this area as it has large implications for the real world treatment of sexual offenders. The current research did indicate that to some degree offenders had more difficulty discriminating between some emotion pairs than non-offenders, particularly when fear was one of the emotions, showing that deficits may exist that could have predisposed them to offending.

Regardless of the lack of significant differences between offenders and non-offenders, this does not mean that either group did not show any deficits in recognition accuracy. Hit rates varied between 75% and 87%, and false alarm rates varied between 19% and 37%, evidence that the accuracy of responding was far from perfect. Future research should also investigate potential links between recognition accuracy and re-offending in child sexual offenders.

Results of future research in this area could have important implications for treatment programmes, particularly if any deficits in recognising facial expressions of children are found in the child sexual offender group. If sexual offenders have a greater difficulty recognising emotions in children than in adults, it would likely benefit them to undergo training to improve their recognition accuracy (of fearful expressions in particular) as it is not uncommon for sex offenders to incorrectly interpret negative facial expressions as sexual

advances or pleasure (Ward et al., 1997). Pollak and Tolley-Schell (2003) demonstrated that facial affect recognition can be significantly improved by the use of a brief implicit computerised training protocol, even in violent offenders who display psychopathic tendencies. This finding is notable and reiterates the importance of examining facial affect recognition deficits in high-risk offenders as these deficits would make it difficult for offenders to not only recognise signs of distress in potential victims, but also to empathise with their past victims, which is an important treatment goal. Training in emotion recognition could be included in treatment programmes, but future research would need to investigate recidivism outcomes following this training to determine its efficacy. In conclusion, more research into the field of emotion recognition with high risk offenders needs to be done to highlight any deficits that can be utilised as treatment targets, potentially resulting in a reduction of recidivism, and improvement of society as a whole due to reduced sexual offending.

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Appendix A – Supplementary Material: Morph Selection

Sadness-Anger

Sadness-Fear

Sadness-Happiness

Fear-Anger

Happiness-Fear

Anger-Happiness